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105. A, DANDYA PURPUSII. a, habit ×⅓; b, flower ×2; c, flower longitudinal section ×4; d, stamens ×8; e, fruit ×2. B, MILLA BIFLORA. a, habit ×⅓; b, scape ×⅛; c, flower longitudinal section ×⅔; d, stamens ×4.

ARTICLE 12.
THE GENUS MILLA (Amaryllidaceæ-Allieæ) AND ITS ALLIES.

By H. E. Moore, Jr.

In the course of my field work in Mexico during the fall months of 1949, a chance collection was made of a few corms of a plant thought to be allied to Milla. The corms survived the journey to Ithaca, were placed in cultivation and in October 1951 and again in 1952 produced flowering scapes. Examination of the flowers indicated that the plants were clearly congeneric with *Milla biflora* but that they differed markedly in vegetative and certain floral characters. At the same time, Milla and Bessera were being reviewed for manuscript of the next edition of Hortus and the following synopsis has resulted from the ramifications of an attempt to ascertain the limits and relationships of those genera. That this synopsis is far from complete will be obvious. Genetical, cytological and anatomical studies are much to be desired to supplement the little information now available.

During this study, correspondence with Mr. John Ingram, comments of colleagues at the Bailey Hortorium and Gray Herbarium and a conversation with Mr. James E. Dandy at the British Museum of Natural History in 1950 have been most helpful. The plates are the work of Marion Ruff (Mrs. Thomas Sheehan) and Miss Mitsu Nakayama. Abbreviations for herbaria are those of Index Herbariorum (Reg. Veg. ii. 106, 1952).

The genus Milla is a member of the tribe Allieæ which was transferred essentially as a unit and without further subdivision from the Liliaceæ to the newly circumscribed Amaryllidaceæ by Hutchinson (Fam. Fl. Pl. ii, 128, 1934). The genera included in the tribe fall in two diverse and well-defined groups. Allium and its allies, not further considered in this paper, have tunicated bulbs and a spathe of two more or less sheathing and generally united bracts subtending the umbel and enclosing the buds. Milla and its allies have corms, a spathe of several distinct spreading bracts not enclosing the buds and other characters of less importance that indicated the necessity for a thorough examination of their relation to Allium.

Because of the considerable and fundamental differences between these groups it was originally proposed to distinguish them formally for purposes of reference in connection with this study. For proper evaluation of their position, however, the whole scheme within the Allieæ and the subfamily Allioideæ needs careful analysis with the integration of evidence from all

disciplines of botany. Neither sufficient information nor time is presently available for such an integration and relationships will be indicated by the use of phrases where necessary.

The unit of eleven genera having corms and including Milla is entirely North American with a southern limit in Guatemala, a northern in British Columbia and an eastern in the plains of Oklahoma and Kansas. It forms a homogeneous alliance that divides naturally into two complexes, each having a separate geographical center of diversity correlated with certain fundamental and divergent morphological trends. The first or Brodiæa complex is centered in the western United States and has corms with fibrous-reticulate tunics, the ovary sessile or on a free gynophore; the second or Milla complex is centered in Mexico and has corms with membranous tunics of minute parallel fibers (described in more detail with *Milla magnifica*), the ovary borne on a short to long gynophore that, with the base of the ovary, is united with the perianth-tube or more generally is merely adnate to it on three angles opposite the outer tepals.

The Brodiæa complex consists of Androstephium, Bloomeria, Brodiæa, Dichelostemma, Muilla, Triteleia, and Triteleiopsis. Except for Androstephium, in which only two well-marked species are known, its components have been monographed in recent years by Hoover [generic discussion, Bull. Torr. Bot. Club, lxvi, 161–166 (1939); Brodiæa, Amer. Midland Nat. xxii, 551–574 (1939); Dichelostemma, Amer. Midland Nat. xxiv, 463–476 (1940); Triteleia, Triteleiopsis, Amer. Midland Nat. xxv, 73–100 (1941)] and Ingram [Bloomeria, Muilla, Madroño, xii, 19–27 (1953)]. Considerable diversity of floral structure is found in the complex with progressive development of a gamophyllous perianth, reduction and specialization in the andrœcium and, in some genera, formation of a gynophore. These developments have largely been treated by Hoover in his various papers and they need not be elaborated upon.

The Milla complex, consisting of Bessera, Dandya, Milla and Petronymphe, is discussed in detail here. Of the four genera Dandya and Petronymphe are monotypic as we presently know them; Bessera here includes two polymorphic species; Milla was for many years considered monotypic but has had varying treatment in the last century and is now interpreted as consisting of six species. The problematical genus Diphalangium, known only from the original description, almost certainly belongs in this alliance and has been combined with Milla by some writers. Its relation to that genus is considered further in discussion of Milla.

Within this complex there is considerable diversity of floral specialization on a basic pattern. Dandya seems to represent the most primitive taxon in having a rotate or more probably a subcampanulate perianth with very short tube and unspecialized stamens. The presence of a very short gynophore and perianth-tube may represent the beginning of a

tendency toward elongation and fusion of parts that appears to have culminated in Milla but it may be argued that the apparently complete fusion of gynophore and perianth-tube is, in itself, a considerable advance. Material available is scarcely adequate to provide the basis for a description of gross morphology and only careful anatomical study can further clarify the situation.

More specialized than Dandya is the genus Bessera. Here there is greater elongation of the perianth-tube and gynophore with incomplete fusion of the two, lacunæ existing between the flanges of the gynophore to the base of the tube. The stamens are distinctly advanced in having the filaments more or less united. In the species of Bessera as delimited here there is a decided difference in degree of union of perianth-parts and stamen-filaments that is treated in later discussion of the genus.

In Petronymphe and Milla there is progressive lengthening of the gynophore and perianth-tube with concomitant diversity of perianth-shape. In Milla, there is a tendency toward reduction of pedicels and stamen-filaments that ends in *Milla biflora* which appears to represent the highest level of evolution in this particular complex. The ontogenetic development of the flower from bud in Milla is readily observed and may throw some light on evolution within the complex. In its initial stages the bud is globose with relatively large and distinct perianth-segments above a short tube. As the flower develops there is a progressive lengthening of the tube with only slight increase in size of the lobes until just before the flower expands when the segments reach their maximum dimensions. In a moderately developed bud the gynophore and vascular supply of the perianth are clearly visible to the naked eye as is the branching of the nerves at the base of the perianth-segments.

A partial synoptical key to American genera of the Allieæ may serve to point out major divisions of the tribe as it is now circumscribed and to relate within it the genera afterward discussed.

1. Spathe-bracts 2, usually united toward the base and ascending or erect, enclosing the buds: rootstock a membranous- or fibrous-coated tunicated bulb: flowers not articulate with the pedicels: plants sometimes alliaceous. .... *Allium, Ipheion, Latace, Leucocoryne, Nothoscordum, Steinmannia, Tristagma.*

1. Spathe-bracts 3 or more, distinct, spreading, not enclosing the buds: rootstock a membranous- or fibrous-coated corm: flowers often articulate with the pedicel: plants never alliaceous.

2. Corm with coarsely or sometimes obscurely (Androstephium) fibrous-reticulate tunics: ovary sessile or if stipitate then the stipe not adnate to nor fused with the perianth-tube: stamens 6 or 3. *Androstephium, Bloomeria, Brodiæa, Dichelostemma, Muilla, Triteleia, Triteleiopsis.*

2. Corm with membranous tunics of minute parallel fibers: ovary borne on a gynophore, the gynophore and base of the ovary united with the perianth-tube or generally adnate to it by lateral flanges opposite the outer tepals: stamens 6.

3. Flowers red, purplish-red, violet or blue; perianth rotate, subcampanulate, campanulate or tubular; stamen-filaments two to many times as long as the anthers; ovary on a short gynophore seldom longer than the free locular portion.

4. Perianth rotate or subcampanulate, blue: stamen-filaments distinct, not exceeding the perianth-segments: ovules 8–10 to a locule..1. DANDYA

4. Perianth campanulate or tubular, red to blue-violet: stamen-filaments united at the base or half-way up in a tube, exceeding the perianth-segments: ovules 20–30 or more to a locule.....2. BESSERA

3. Flowers white, pink, blue or yellow-green; perianth hypocrateriform or tubular; stamen-filaments shorter than to twice as long as the anthers, ovary on a gynophore somewhat longer than to many times as long as the free locular portion.

5. Perianth tubular, yellow-green: gynophore only slightly exceeding the free locular portion of the ovary: flowers not fragrant: leaves triangular in section, solid, abaxially keeled...3. PETRONYMPHE

5. Perianth hypocrateriform, white, blue or pink: gynophore two to ten times as long as the free locular portion of the ovary: flowers sometimes fragrant: leaves plano-convex or subterete, hollow except at the base.....4. MILLA

† 1. **DANDYA,** gen. nov.

Herba perennis; cormus membranaceo-tunicatus: folia 3 vel plura (?) linearia plano-convexa vel subteretia scapo breviora: inflorescentia scaposa umbellata pluriflora bracteis 3–4 lanceolatis membranaceis distinctis; flores pedicellati pedicellis bracteatis ad basin florum articulatis; perianthium rotatum vel subcampanulatum tubo segmentis 6 ovato-lanceolatis uninervatis breviore; stamina 6 ad faucem inserta filamentis longis liberis subulatis et antheris subbasifixis; ovarium triloculare stipitatum stipite ad tubum perianthii adnato, ovulis 8–10 in axe loculi biseriatis, stylo elongato, stigmate trilobato: fructus capsularis; semina irregulariter compressa, nigra. Typus *Dandya Purpusii*.

Perennial herbs with solitary scapes and 3 or more (?) leaves from a corm: corm with brown membranous outer tunics of numerous minute parallel fibers and thinner yellow or brown inner tunics all produced in a truncate collar about the base of the leaves: leaves grass-like, shorter than the scape, plano-convex or subterete and hollow (?): scape erect, slender and hollow above the base: inflorescence umbellate, subtended by 3–4 distinct, acute, scarious bracts not enclosing the buds; flowers several, erect, articulate at the base with the bracteolate pedicels, blue, the perianth rotate or probably subcampanulate with a very short tube much exceeded by the 6 ovate-lanceolate 1-nerved (?) segments, inflated about the capsule in fruit; stamens 6 inserted at the throat of the tube, the filaments adnate to the perianth-tube below, subulate and free above, shorter than the segments, the anthers oblong, versatile, subbasifixed, subsagittate at the base; ovary superior, trilocular with 8–10 biseriate axile ovules in each locule, subsessile on a very short gynophore, the gynophore and base of the ovary apparently united with the perianth-tube, free above, the style slightly shorter than to equalling the stamens, stigma trilobed: capsule trilocular, loculicidal, acute; seeds few, black, irregularly flattened and ridged through mutual pressure, the testa minutely granular.

† **Dandya Purpusii,** (Brandegee) comb. nov. Fig. 105A.

Muilla Purpusii, Brandegee, in Univ. Calif. Publ. Bot. iv, 177 (1911).

Brodiæa Purpusii, (Brandegee) Ingram, in Madroño xii, 27 (1953).

Corm ca. 15 mm. in diameter with a collar 7 mm. high: leaves 15 cm. long, 1 mm. wide, minutely hyaline-denticulate along the nerves: scape

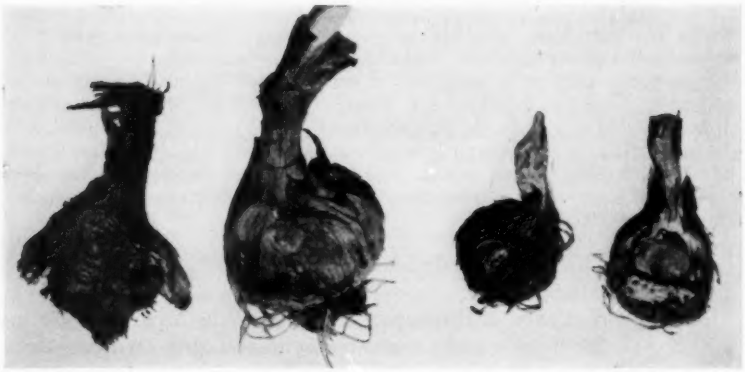
1.8–4.5 dm. high, smooth or minutely scabrescent at the base: spathe-bracts 4–7 mm. long, scarious-margined, strongly 3-nerved: flowers 7–12 on pedicels 1.3–2.5 cm. long, deep blue, the perianth-tube 2–3 mm. long, the segments to 9 mm. long with a central dark probably green stripe, appearing 1-nerved but perhaps obscurely 3-nerved, the outer callous-tipped, the inner acutish; stamen-filaments blue, 3–4 mm. long, adnate to the perianth-tube for about 1 mm. above the base of the ovary, free above, subulate, anthers yellow, 2 mm. long; ovary 3 mm. long on a gynophore 0.5–1 mm. long, style 3 mm. long: capsule acute, 10 mm. long; seeds 4 mm. long, 3–5 to a locule.

Mexico: Coahuila; Sierra de la Paila, October 1910, *Purpus 4959* (UC, holotype; F, GH, isotypes).

During a discussion of Hutchinson's concept of the Amaryllidaceæ one day in 1950, Mr. Dandy and I compared notes and ideas on generic relationships and found that we had independently arrived at rather similar conclusions regarding the genera related to Allium and Milla. He suggested at the time that *Muilla Purpusii* might represent a distinct genus. For reasons summarized below this species appears more closely related to Bessera than to Muilla or other genera of the Brodiæa complex. Inasmuch as it cannot be placed in Bessera if that genus is to retain its distinctive character, it is here given equal status as a genus. It is a privilege to associate Mr. Dandy's name with it, recognizing his studies in the family and his assessment of the taxon.

Ingram (Madroño, xii, 27, 1953) has excluded *Muilla Purpusii* from Muilla and rightly so. Assignment of it to Brodiæa, however, is not in harmony with Hoover's delimitation of that genus. Brodiæa has fibrous-reticulate corm-tunics and only three fertile stamens while the species under consideration has corm-tunics with minute parallel fibers and six fertile stamens, being similar in these important respects to the Mexican genera.

As has been pointed out previously, the character of the corm coat has often been overlooked but in the Brodiæa and Milla complexes offers a valuable criterion for generic delimitation when used in conjunction with other characters. The presence on the corm of tunics with parallel rather than reticulate fibers is the primary and most obvious character demanding the separation of Dandya from Muilla and Brodiæa and, indeed, from casual observation might seem the only one. Considering the uniformity of the fibrous-reticulate tunics in the Brodiæa complex, including Muilla (Fig. 106), and the similar homogeneity of the minutely and parallel-fibrous tunics in the Milla complex (Fig. 106) it would also seem sufficient. There is, however, other evidence to strengthen the elevation of Dandya to generic rank. In Muilla, the ovary is distinctly sessile and not clearly articulate with the pedicel. In fruit there is no indication of a stipe below the ovary and the lines of union between perianth and pedicel become



106. CORM-TUNICS, Milla and Brodiæa complexes. Left to right: *Milla biflora* with outer tunic (*Moore 2035*); *Bessera elegans* with inner tunics (*Moore 5144*); *Triteleia laxa* with fibrous-reticulate tunic (*Dress 1008*, BH); *Triteleia ixioides*, corm in section (*Gillespie 966*, BH).

enlarged and horny. On the other hand, in Dandya a short stipe 0.5–1 mm. long may be observed clearly in old flowers and in fruit and there is no horny enlargement of the base of the perianth except for a more marked articulation between flower and pedicel.

The material of *Dandya Purpusii* is too limited to permit further conclusions and more adequate herbarium specimens and preferably living plants are much to be desired to augment our meager knowledge of the genus. Although both Muilla and Dandya are apparently relatively unspecialized in their respective groups and are not distinguished by obvious floral characters, the separation of the two on the basis of the corm alone would seem desirable to clarify relationships. Of equal importance in any phylogenetic consideration, however, is the presence of the presumably incipiently stipitate ovary. It is to be hoped that anatomical studies of the flower will eventually add to our store of knowledge concerning relationships, but until material for such studies is available conclusions based on gross morphology must suffice.

Within the Milla complex, Dandya is most closely related to Bessera and particularly *B. elegans* (cf. group C) in the relatively unspecialized flower with short tube, long segments and stamens with filaments longer than the anthers. It differs in the more shortly stipitate ovary with the gynophore apparently completely fused to the perianth-tube, in the distinct and scarcely exserted stamens, and fewer ovules to a locule.

2. **BESSERA,** Schult. f. in Linnaea, iv, 121 (1829) *nomen conservandum*, not Schult. Obs. Bot. 27 (1809) nor Spreng. Pugill. ii, 90 (1805) nor Vell. Fl. Flum. 147 (1825); iv, t. 2 (1827).

Pharium, Herb. in Bot. Reg. xviii, t. 1546 (1832).

Behria, Greene, in Bull. Calif. Acad. ii, 143 (1886).

Perennial herbs with solitary scapes and 1–2 or more leaves from a corm: corm with brown membranous outer tunics of numerous minute parallel fibers and thinner yellowish or brownish inner tunics, all produced in a truncate collar about the base of the leaves: leaves linear, slender and plano-convex or nearly terete, fistulose: scape erect, hollow: inflorescence umbellate, subtended by 3–4 short, acute, distinct, spreading bracts not enclosing the buds; flowers few to numerous, articulate at the base with the short to long slender bracteolate pedicels, red to purplish-red, pink or violet, often with white or violet markings, nodding or more rarely ascending to erect at anthesis, erect in fruit, the perianth-tube attenuate and adnate to the gynophore and base of the ovary below, sometimes more or less saccate at the point of union, campanulate to cylindric above with oblong- or ovate-lanceolate lobes one-tenth to two or more times as long as the tube, inflated and persistent about the capsule in fruit; stamens 6, exserted, united to the perianth below, free above the base of the ovary with the filiform filaments united in a very short to long tube, sometimes with intercalary teeth at the apex; anthers ovoid or oblong, versatile, dorsifixed above the shortly sagittate base, introrse, generally bluish or greenish when dehisced; ovary superior, trilocular, borne on a gynophore, the gynophore and base of the ovary adnate to the perianth-tube on three angles opposite the outer tepals, ovules axile, 20–30 or more and biseriate in each locule, style elongate and generally exceeding the stamens, stigma tubæform or obscurely trilobed: fruit an acute loculicidal capsule; seeds numerous, irregularly flattened, angled and ridged through mutual pressure, the testa black, minutely granular. Type species *Bessera elegans*.

Bessera is readily distinguished by the brilliantly colored flowers and the exserted stamens with the filaments united in a very short or a long tube. The ovary on casual observation appears sessile and was so described by Baker (Journ. Linn. Soc. Bot. xi, 373, 1871) but examination shows it to be borne on a gynophore that, with the base of the ovary, is adnate to the perianth-tube on three angles with lacunæ between. Baker also described the capsule of Bessera as septicidal in dehiscence (op. cit. 355, 373) but in no instance has this proved so, all the fruiting material seen having loculicidal dehiscence.

Macbride has pointed out (Contr. Gray Herb. lvi, 11, 1918) that the floral morphology of Behria is different from that of Bessera only in the degree of fusion of parts. With the accumulation of material including corms, unknown to Greene, additional evidence uniting the two genera is provided. The structure of the corm and its tunics is that of Bessera rather than that of the Brodiæa complex. It is apparent that two lines of development are involved from ancestral stock probably having a short perianth-tube, elongate segments and distinct or only shortly united stamen-filaments. In one direction the perianth-segments appear to have

remained elongate while the stamen-filaments have become united in a long tube (*B. elegans*), in the other the perianth-tube has developed while the filaments are united only at the very base (*B. tenuiflora*).

Krause (Engler and Prantl, Nat. Pflanzenfam. Aufl. 2, 15a, 324, 1930) retained Behria as a distinct genus but united Androstephium with Bessera. Because of the obscurely fibrous-reticulate tunics of the corm, the flowers with sessile ovary and stamens shorter than the segments, Androstephium is considerably more distinct from Bessera than is Behria in spite of a similar but exaggerated union of the stamen-filaments. It should be retained as a distinct genus while Behria, because of its obviously close relationship, is considered a synonym of Bessera.

As treated here, Bessera consists of two polymorphic species distinguished as follows:

1. Perianth-tube shorter than to equalling the segments: stamen-filaments united one-fourth to one-half their length in a membranous tube.....1. *B. elegans*
1. Perianth-tube four or more times as long as the segments: stamen-filaments united at the base in a low ring scarcely 1 mm. high.....2. *B. tenuiflora*

1. **Bessera elegans,** Schult. f. in Linnaea, iv, 121 (1829). Fig. 107B.

Pharium fistulosum, Herb. in Bot. Reg. xviii, t. 1546 (1832).

Bessera Herbertii, G. Don in Sweet, Hort. Brit. Ed. 3, 694 (1839).

Pharium elegans, (Schult. f.) Steud. Nom. Ed. 2, ii, 316 (1841).

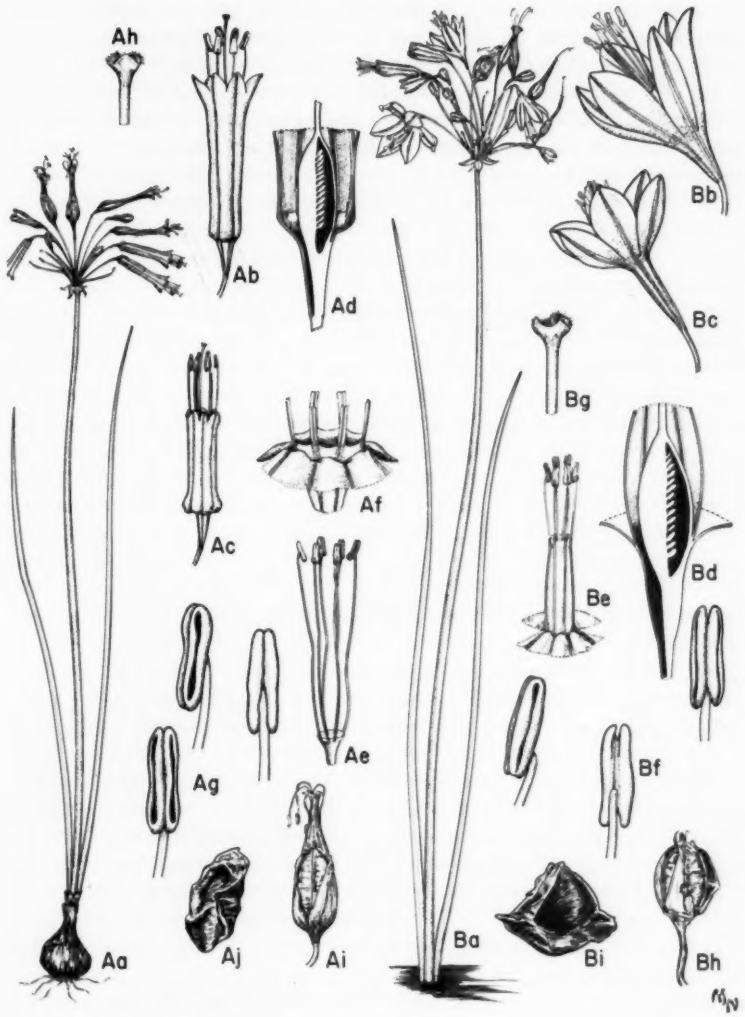
Pharium Herbertii, (G. Don) Steud. Nom. Ed. 2, ii, 316 (1841).

Bessera multiflora, Martens & Galeotti, in Bull. Acad. Brux. ix (2), 385 (1842).

Bessera miniata, Lem. in Fl. des Serres, iv, t. 424 (1848).

Bessera fistulosa, (Herb.) Lindl. ex Pritzel, Icon. Bot. Ind. 148 (1855).

Corm ca. 2 cm. wide, 1.5 cm. high, with dark brown or grayish tunics and a collar 1.5 cm. high: leaves green, 2–3, plano-convex, fistulose, to 8 dm. long, 2–4 mm. wide, the nerves minutely hyaline-denticulate: scape 2–9 dm. high, 1–5 mm. in diameter, smooth or slightly scabrellous, often purple-flecked toward the base; spathe-bracts 5–15 mm. long; umbel 2–30-flowered, the flowers (1.5)–2–3 cm. long, campanulate, odorless, scarlet to purple with green nerves outside, striped with white inside, nodding or rarely ascending to erect (?) at anthesis becoming erect in fruit, on pedicels (0.6)–2–6–(10) long, the perianth-tube 5–13 mm. long, rather abruptly or gradually expanded above the slender base, the segments ovate-lanceolate, 3-nerved, (7)–12–22 mm. long, 3–8 mm. wide, more or less spreading; stamens little to much exserted, inserted at the throat, the white, scarlet or violet, generally muriculate filaments connected by a thin truncate or toothed white or violet-flushed membrane for one-fourth to one-half their length, distinct and subulate above, 17–25 mm. long, anthers ellipsoid, 1–2.5 mm. long, blue at dehiscence; ovary 3–5 mm. long on a gynophore (3)–5–13 mm. long, the style slender, elongate, usually exceeding the stamens, the stigma tubæform or obscurely trilobed, papillate-fringed at the margin, smooth within, ovules 30–34 to a locule: capsule acute, 15–20 mm. long, 7 mm. wide; seeds 3 mm. long, shining, black.



107. A, BESSERA TENUIFLORA (*Hammerly 229* except Ac). a, habit ×⅓; b, flower exterior view ×1; c, flower exterior view ×1 (*Carter et al 2219*); d, base of flower longitudinal section ×3; e, androecium ×1; f, stamen-tube ×3; g, anthers ×4; h, stigma ×4; i, fruit ×1; j, seed ×6. B, BESSERA ELEGANS (*Moore 5144* except Bc). a, habit ×⅓; b, flower exterior view ×1; c, exterior view ×1 (*Hinton 939*); d, face of flower longitudinal section; e, androecium ×1; f, anthers ×4; g, stigma ×4; h, fruit ×1; i, seed ×6.

Bessera elegans is not a homogeneous species and the specimens that have been available for study fall in three groups referred to hereafter as A, B and C. Although collections may be separated as indicated below, I am not prepared to assign them definite status in subspecific or varietal categories. Within each group there is limited variation among populations and even among individuals of populations as they are represented by specimens. The lines between groups and especially groups A and B are not always clear. The single collection representing group C is strikingly different from those of group A and at first was thought to represent a distinct taxon. It is approached by specimens referred to group B, especially in the short pedicels and nearly erect purple flowers of *Pennell 19738* from Sinaloa. It is possible that the Howell specimens cited are no more than depauperate plants although they are uniform in character. It will be noted that groups B and C have a limited distribution within the general range of group A but in the area of coincidence there is no apparent altitudinal or edaphic pattern. Correlated with morphological differences this suggests the possibility of polyploid relationships of some kind. Since no information bearing on the cytology or genetics of the species is available, since there is no apparent geographic correlation and since the three groups bear close resemblance to each other and more or less intergrade, it is felt that it would be premature to attempt a designation based on gross morphology alone. To understand these taxa fully will require patient field and laboratory study, neither of which can be accomplished at present.

In the group most widespread (group A) the nodding flowers are often as many as 30 in the umbel on pedicels 2–6–(10) cm. long and usually brilliantly colored. The perianth-tube is 5–10 (exceptionally to 13 as in *Nagel 8100*) mm. long, rather abruptly expanded about the base of the ovary and seldom equalling the body of the ovary in length (Fig. 107Bb), the perianth-lobes are one and a half to two (rarely one) or more times as long as the tube, the stamens are mostly prominently exserted with a generally dentate tube, often violaceous or red filaments and with anthers 2 mm. long or more when dry, the leaves and scape are stout. The following specimens are assigned here including *Nagel 8100* from Morelos which, although having an exceptionally long perianth-tube, is typical in color, stature, and stamens.

Mexico: Sinaloa; Municipality Concordia, Santa Lucia, 1500 m., September 1919, *Dehesa 1554* (US); San Agustin, 1921, *Ortega 4019* (US); between Rosario and Colomas, July 12, 1897, *Rose 1611* (NY, US): Durango; without data, *Ibana Garcia 643* (US): Jalisco; road to San Domingo mines, Etzatlán, 6000 feet, October 6, 1908, *Barnes & Land 317* (F); La Palma, June 9, 1892, *Jones 457* (US); barranca near Guadalajara, June 1886, *Palmer 128* (GH, NY, US); hillsides near Gua-

dalajara, June 28, 1889, *Pringle 2557* (F, GH, NY, UC, US); verge of cliffs, Barranca of Guadalajara, 5000 feet, July 19, 1902, *Pringle 11195* (F, GH, US); road between Colotlán and Bolaños, September 7–9, 1897, *Rose 2835* (GH, US); Sierra Madre of Bolaños, September 17, 1897, *Rose 3728* (US); near Tequila, July 5–6, 1899, *Rose & Hough 4750* (US); near Etzatlán, October 2, 1903, *Rose & Painter 7555* (NY, US): Michoacán; District Apatzingán, 450 m., August 17, 1938, *Hinton 12035* (NY, US); District Coalcomán, Pto. Las Cruces, 1280 m., September 12, 1938, *Hinton 12185* (NY, US); District Uruapan, Tancitaro, 1900 m., October 18, 1940, *Hinton 15547* (US); trail from Apatzingán to Tancitaro, 3000–4000 feet, August 7, 1940, *Leavenworth 501* (GH, NY): México; District Temascaltepec, Volcán, 1430 m., July 18, 1932, *Hinton 1083* (NY, US); Temascaltepec, 1750 m., September 1, 1932, *Hinton 1516* (NY); Tejupilco, 1340 m., September 3, 1932, *Hinton 1598* (NY, US); Chorrera, 1230 m., September 25, 1932, *Hinton 1840* (F, GH, NY); Naranjo, August 27, 1934, *Hinton 6505* (NY, US): Morelos; Huajintlán, July 1929, *Lyonnet 309* (GH, NY, US); El Tizcal, east of Cuernavaca, 1500 m., September 12, 1932, *Nagel 8100* (GH); Xochicalco, September 29, 1910, *C. & E. Seler 5392* (GH): Guerrero; Taxco, August 31, 1937, *Abbott 394* (GH); near Balsas, July 1940, *Halbinger 20* (GH); District Mina, Calavera, 700 m., September 4, 1936, *Hinton 9351* (GH, NY, US); Parotas, 800 m., August 31, 1936, *Hinton 9404* (NY, US); Zihuagio-Filo Mayor, 1660 m., October 16, 1936, *Hinton 9704* (GH, NY, US); District Montes de Oca, Vallecitos, June 30, 1937, *Hinton 10543* (GH, NY, US); near Taxco, July 18, 1939, *Kenoyer A532* (F); same locality, August 23, 1940, *Kenoyer C213* (GH); between Acahuizotla and Agua de Obispo on highway to Acapulco, ca. 3000 feet, October 1, 1949, *Moore 5144* (BH); Limon Mt., 4000 feet, July 28, 1910, *Rusby 347* (NY, US).

In the second group (group B) the nodding flowers are 2–8 to an umbel on pedicels 2–5 cm. long, often pale in drying with a bluish or purplish cast and noted as varying from red or pink to purple in the wild. The perianth-tube is 10–15 mm. long, gradually enlarged upward and generally equalling or exceeding the body of the ovary in length (Fig. 107Bc), the perianth-lobes are 10–14 mm. long, shorter than to equalling or slightly exceeding the tube in length, the stamens are generally less prominently exserted with a usually edentate tube, pale filaments and anthers 1–1.5–(2) mm. long when dry, the leaves and scape are generally slender. Here belong the following:

Mexico: Sinaloa; loam flat north of Mazatlán, 5–20 m., August 16, 1935, *Pennell 19738* (US): Michoacán; District Zitácuaro, Zitácuaro-Tuzantla, August 9, 1938, *Hinton 13072* (NY, US); District Coalcomán, Villa Victoria, 600 m., July 10, 1939, *Hinton 13902* (GH, NY, US): México: District Temascaltepec, Paso de Vigas, 1080 m., July 2, 1932,

Hinton 939 (GH, NY, US): Guerrero; District Mina, Placeres, 400 m., July 28, 1936, *Hinton 9180* (NY, US); District Galeana, Moreno-Camalote, 500 m., June 26, 1939, *Hinton 14353* (GH, US); Sierra Madre between Tlacotepec and Ajuchitlán, 1400 m., June 16, 1899, *Langlassé 1064*[1] (GH, US).

In the third and most distinct group (group C) the flowers are 3–5 to an umbel, blue-violet or violet when dry, similar in aspect to group B but small in size (13–15 mm. long) and apparently ascending or erect on very short pedicels (6–8 mm. long). The perianth-tube is about 6 mm. long, attenuate at the base and rather abruptly expanded about and equalling or exceeding the ovary, the segments are 7–9 mm. long, the stamens are scarcely exserted with edentate tube, pale filaments and anthers 2 mm. long, the ovary is small (3 mm. long) on a gynophore 3 mm. long with about 20 ovules to a locule, the leaves and scape are slender. Mexico: Nayarit; Punta Mita, July 22, 1932, *Howell 10377* (GH, US).

Bessera elegans is a strikingly handsome plant in the wild or in cultivation and was introduced into Europe in the last century by several collectors. In Mexico it is sometimes known as "Aretillo." The names cited in synonymy appear to belong with group A above. Type material of *B. elegans* has not been available but Schultes gave a long and detailed description based on a Karwinsky collection of 1827 said by Lindley (Bot. Reg. xxv, t. 34, 1839) to have come from Saltepec (Sultepec ?), Mexico. The flowers as described are somewhat smaller than the average, measuring 16–22 mm. in length, and of blue, violet or red color with 3–16 in the umbel. The perianth-tube is described as short, turbinate-campanulate, 3–5 mm. long on a stipe of 3–5 mm. long, the segments 10–14 mm. long. These measurements and the large number of flowers correspond with characters of group A and the dentate stamen-tube with colored filaments 2–6 mm. longer than the segments is clearly the type found in group A. The paler color of the flowers, more usual in group B, may be attributed to drying techniques and is matched by such modern specimens as *Hinton 1598, 1840, 9704* and *10543*. Thus the typical element of the species appears to belong with the more widespread facies.

The disposition of *Pharium fistulosum*, later renamed *B. Herbertii*, is less certain. In the 6-flowered umbel and rose-purple flowers it resembles group B but the much-exserted stamens with colored filaments and the apparently short perianth-tube illustrated are those of group A. The species was described from a plant in cultivation and Herbert remarked that the scape was at first weak and pale but that it acquired vigor when set out-of-doors. To this factor the few and pale flowers might be ascribed. Herbert does not mention Bessera in his description of Pharium and it

[1] Locality information for the Langlassé collection is taken from McVaugh, Candollea, xiii, 188 (1951).

seems likely that he was unaware of Schultes' publication. It is a matter of regret that Bessera was conserved for such a small genus when the most fitting name Pharium (from the Greek for a veil, alluding to the concealment of the ovary in the stamen-tube) was available.

In the summer of 1950 I photographed most of the Martens and Galeotti types at Brussels but failed to find the type of *B. multiflora* (*Galeotti 5506*) nor has it appeared in material available for study. The description is brief but the numerous flowers (15–20) of carmine color with blue stamens are all typical of group A. The edentate staminal tube upon which emphasis was placed does occur within group A as well as group B but to a lesser extent and flowers of the same umbel sometimes exhibit both dentate and edentate tubes.

B. miniata as described and figured by Lemaire is readily referred to group A because of the numerous brilliantly colored flowers with short tube and long segments, dentate stamen-tube and colored filaments. It was distinguished from *B. elegans* by the rounded, not trilobed stigma and from *B. Herbertii* by the dentate stamen-tube. Lemaire also distinguished his species from *B. elegans* as illustrated by Lindley (Bot. Reg. xxv, t. 34, 1839) on characters of the anthers that are no more than stages of development, those shown by Lindley being yet filled with pollen, those by Lemaire dehisced. In none of the above instances do characters hold when a suite of specimens is examined.

Variation in color from scarlet to purplish-red, purple or even pink has been noted by collectors but commonly the nodding flowers are brilliant scarlet with conspicuous white stripes on the inner surface of the segments, often bright stamen-filaments and a white or violaceous filament-tube. The plants are frequently abundant in regions of oak or pine and oak forests along trails or in open places and seem to prefer soils of volcanic origin. In some instances they have been noted as growing in water. In cultivation they respond well to usual methods for bulbs and have become a standard offering in the trade. Such plants as have been seen in cultivation in this country and abroad are the brilliantly colored kind referred to group A.

Despite infraspecific differences, *Bessera elegans* as delimited here is readily distinguished from *B. tenuiflora* by the relatively short perianth-tube, long segments and long stamen-tube.

2. **Bessera tenuiflora,** (Greene) Macbride, in Contr. Gray Herb. lvi, 11 (1918). Fig. 107A.

Behria tenuiflora, Greene, in Bull. Calif. Acad. ii, 143 (1886).

Corm 1.2–1.5 cm. in diameter, 1–1.5 cm. high with a collar 0.7–1 cm. high: leaves 1–2, to 4.6 dm. long, 1.5 mm. wide, narrowly linear: scape 2.7–5.3 dm. high, 2–3 mm. in diameter; spathe-bracts 5–8 mm. long: umbel 5–20-flowered; flowers 18–30 mm. long, tubular, scarlet or orange-red with

yellow nerves, yellow in folds of throat and sometimes the lobes violet-margined, nodding at anthesis, becoming erect in fruit, on pedicels 1.5–3 cm. long, the perianth-tube 1.6–2.5 cm. long, 3–5 mm. wide at anthesis, more or less saccate at the union of ovary and tube and narrowed upward to the throat with erect lobes or gradually widened upward with more or less spreading lobes, the lobes 3-nerved, 2–4–(7) mm. long, 1–5 mm. wide; stamen-filaments united in a low ring 0.5–1 mm. high above the base of the ovary, free and exserted above, anthers 1.5–3 mm. long, often greenish when dry; ovary 4–6 mm. long on a gynophore 3–7 mm. long, ovules 20–30 to a locule, style generally exceeding the stamens, stigma tubæform or obscurely trilobed: capsule 11–15 mm. long, ca. 4 mm. wide; seeds black, shining, 2 mm. long, minutely granular.

Bessera tenuiflora is known only from the southern portion of Baja California del Sur in Mexico and like *B. elegans* has two recognizable floral facies. In one group of specimens (group A), including the type material, the perianth is small, 18–22–(25) mm. long, broadest and often prominently saccate at the junction of the tube and ovary narrowing upward to a slender throat with erect, short, narrow lobes 2–4 mm. long, 1–2 mm. wide margined with deep violet (Fig. 107Ac). Representatives are: San José del Cabo, year and collector unknown, ex Herb. Calif. Acad. Sci. (UC, portion of holotype); San José del Cabo, September 25, 1890, *Brandegee 582* (GH, NY, UC, US); granitic gravel ridge near ocean, 12.2 km. southwest of San José del Cabo, December 16, 1947, *Carter, Alexander & Kellogg 2219* (UC, US); Cerro Colorado, San José del Cabo, March 1899, *Grafendörfer s.n.* (UC). A fruiting specimen (*Rose 16400*, US) from Cape San Lucas may belong here, but, lacking perianth, cannot be definitely assigned.

A second group (group B) has the perianth larger, (22)–25–30 mm. long, narrow and generally less prominently saccate at the base, gradually widened upward to the throat with somewhat spreading longer and wider lobes (3)–4–7 mm. long, 3–5 mm. wide without dark marginal coloring (Fig. 107Ab). Here belong the following specimens: La Chuparosa, October 2, 1899, *Brandegee s.n.* (NY); sandy plain about 20 miles south of La Paz on Todos Santos road, October 8, 1941, *Hammerly 229* (GH, US); Todos Santos, February 11, 1928, *M. E. Jones 24528* (GH); The Laguna, Laguna Mountains, September 22, 1930, *Jones 27611* (NY, UC); road from Valle Flojo to El Pescadero, 200–500 feet, December 27, 1905, *Nelson & Goldman 7356* (US).

An additional collection proves perplexing. *Brandegee sine numero* from El Taste, September 11–16, 1893 has been seen from three herbaria. The specimens at the University of California are representative of group A, having short perianth-tubes with strict dark-margined lobes; specimens at the Gray Herbarium and New York Botanical Garden are poorly prepared but appear to be referable to group B. The date for this collection

has been taken from Moran (Madroño, xi, 257, 1952) who indicates the route followed by Brandegee in September 1893. Areas in which both types of flower occur were visited by Brandegee during the September trip on which the specimens were taken, hence it may be supposed either that the two forms do occur together or that different material was united under one locality.

Except for the above, it will be noted that group A is apparently restricted to low elevations in the region of San José del Cabo. Group B is found either farther north at low elevations (Todos Santos) or at high elevations (La Chuparosa, La Laguna). The explanation of the distribution and floral variation awaits future students of the flora of Lower California.

Reasons for placing this species in Bessera have been given in discussion under the genus. As far as is known it is not in cultivation but it is scarcely less handsome than *B. elegans* and should repay introduction.

Excluded species: *Bessera breviflora*, (Wats.) Jepson, Fl. Calif. i, 291 (1921) = **Androstephium breviflorum,** Wats.

3. **PETRONYMPHE**, H. E. Moore, in Gent. Herb. viii, 258 (1951).

During the summer of 1952, corms of *Petronymphe decora* flowered in the Bailey Hortorium garden. It was possible to restudy the flowers from fresh material and notes were made supplementing the original description.

Dissection of fresh flowers showed that the description taken from the dried flowers of a unicate specimen was in error. The gynophore was described as free but is actually adnate to the perianth-tube on three angles up to and including the base of the ovary, exactly as in Milla and Bessera, and the ovules are axile. The stigma is trilobed when fresh and there is a distinct articulation at the base of the flowers.

Petronymphe decora, H. E. Moore, l. c. Fig. 104.

Garden material is more vigorous than that seen in the wild, with 5–7 leaves up to 6.4 dm. long and 7 mm. wide. The leaves are lively green, channeled above and prominently keeled below. At first they are semierect but become lax and arcuate or prostrate at flowering time. Measurements of fresh flowers do not differ materially from those previously given but it may be noted that the perianth is pale yellow with green lines, the lobes are spreading, the stamen-filaments are pale yellow, the anthers are deep blue-violet when fresh with sagittate bases and are incurved toward the style.

Because no fruiting material was found at the type locality and later efforts to recollect material have been of no avail, it was desired to obtain fruit and seed in cultivation. Two inflorescences were in anthesis at the same time and all possible crosses between the two plants were made

without success. Apparently the corms gathered were clonal and the plants now in cultivation are sterile on selfing and cross-pollinating.

4. **MILLA,** Cav. Icon. Pl. ii, 76 (1793).

Millea, Willd. Sp. Pl. ii, 62 (1799).

Askolame, Raf. Fl. Tellur. ii, 11 (1836) [1837].

Perennial herbs with solitary or rarely 2 scapes and 2–7 leaves from a corm: corm with brown membranous outer tunics of numerous minute parallel fibers and thinner yellowish or brownish inner tunics, all produced in a truncate collar about the base of the leaves: leaves elongate, fistulose, linear, plano-convex to subterete and slightly flattened adaxially, smooth or sometimes roughened or minutely hyaline-denticulate along more or less prominent nerves: scape erect, slender and nearly solid to stout and hollow above a solid base: inflorescence umbellate, subtended by 4 acute distinct chartaceous spreading bracts not enclosing the flowers in bud; flowers erect, white with longitudinal green stripes, blue, pink or white flushed with pink, the perianth-tube one and a half to six times as long as the spreading or rarely suberect 3–5–(7)-nerved segments, somewhat ventricose about the ovary, inflated and persistent about the capsule in fruit; stamens 6, inserted at the throat of the tube, filaments distinct, generally shorter than to twice as long as the anthers, anthers linear-oblong to deltoid, basifixed or subbasifixed, introrse, erect and often appressed to the style; ovary superior, trilocular, borne on a gynophore two to ten or more times as long as the free portion of the ovary, the gynophore and base of the ovary adnate to the perianth-tube on three angles opposite the outer tepals; ovules numerous, axile, biseriate in each locule; style equalling the perianth-tube or generally exserted, the stigma trilobed: fruit a loculicidal capsule; seeds numerous, black, irregularly flattened, angled and ridged through mutual pressure, the testa dull or shining, minutely rugose or granular. Type species *Milla biflora.*

Until recently there have been only two known species of Milla in its most restricted sense, *Milla biflora* and *M. Bryanii.* The first is widely distributed in the mountains from southern Arizona to northern Guatemala; the other is restricted to calcareous mountains of Coahuila in northern Mexico. Dr. Ivan Johnston has mentioned in conversation that he has generally seen *M. biflora* on volcanic areas in northern Mexico. The same is true for the portions of central Mexico where I have seen it growing. He further pointed out that *M. Bryanii* occurs only on limestones. This is also true of *M. magnifica* described herein as new and probably of *M. rosea,* but no information is available for the two remaining species, *M. delicata* and *M. Mortoniana.*

These observations coincide with some that may be made with regard to specialization within the genus. Those species with pedicellate flowers having stamens with relatively long filaments are apparently most primitive and are of restricted range as we know them now. They are known or presumed to occur on older limestone formations. *Milla biflora,* on the

other hand, exhibits several characters indicating specialization: the flowers are sessile in reduced number or even solitary and the stamens are shortly exserted with nearly sessile anthers. It is by far the most widespread and variable species and the only one known to occur on the more recently available volcanic soils of the central mountain-mass.

Unfortunately, neither time nor materials have been available for the detailed study of cytology, genetics and floral anatomy that may someday throw more light on the behavior and origin of species within the genus. On the basis of present evidence, however, certain probable relationships may be indicated. *Milla magnifica*, *M. Bryanii*, *M. rosea* and *M. biflora* are clearly closely related, all having very similar large white or pink flowers. Of these *M. magnifica* would appear to be the most primitive in its large size, numerous pedicellate flowers with prominent stamen-filaments and numerous ovules. *M. Bryanii* and *M. rosea* are intermediate in having more slender vegetative parts and fewer pedicellate flowers still with prominent stamen-filaments but with a reduced number of ovules. *M. biflora* represents the most advanced species in the genus in its small size, very few and sessile flowers with nearly sessile anthers and relatively fewer ovules.

Two species from Guerrero, *M. delicata* and *M. Mortoniana*, are markedly different from the others in their small flowers with short perianth-tubes and appear to be more closely related to each other than to the remainder. There is remarkable specialization in the stamen-filaments of *M. Mortoniana* and reduction of them in *M. delicata* but the flowers retain the typical characters of Milla.

The name Milla, Vandelli (Fl. Lusit. et Bras. Spec. 43, 1788) is listed by Index Kewensis, ii, 237 (1895) and if correct would antedate the familiar Milla of Cavanilles. Referring to Vandelli's original publication, however, one finds the name spelled Mella, a name correctly listed on page 201 of the same volume of Index Kewensis where it is referred to a genus in the Scrophulariaceæ. Milla, Vandelli ex Index Kewensis, is in error and does not affect the nomenclatural status of Milla, Cav.

Generic synonymy cited here is at variance with that of Index Kewensis, ii, 237 (1895), Dalla Torre & Harms, Gen. Siphon. 66 (1900) and Krause, Engler & Prantl, Nat. Pflanzenfam. Aufl. 2, 15a, 325 (1930) in that two genera of Rafinesque have been excluded. One, Ipheion, is now accepted as a valid genus (Stearn, in Gard. Chron. ser. 3, cxiv, 60, 1943), the other, Tulophos, based on *Triteleia grandiflora*, Lindl. and *T. laxa*, Benth., is referable to Triteleia, although it was overlooked by Hoover in his monograph of the genus (Amer. Midland Nat. xxv, 78, 1941).

A third genus, Gyrenia, Knowles & Westc., with a single species, *G. biflora*, Knowles & Westc., is also excluded since the extremely brief description consisting principally of symbols in Loudon's Hortus Britannicus,

is impossible to apply. There is no reference to any prior publication or plate and the relationship indicated as "? Asphodeleæ" in addition to the fact that *Milla biflora* is listed (op. cit. p. 649) with disparate characters raises doubt as to its retention in the synonymy of Milla. It is best treated as a *nomen confusum* inapplicable to any genus from the characters given.

Baker (Journ. Bot. xii, 5, 1874) and some other writers have also considered Diphalangium, Schauer, synonymous with Milla. If this be so, then the description is faulty for certain discrepancies are difficult to reconcile. Diphalangium with its only species, *D. graminifolium*, Schauer, was based on an Aschenborn collection from Mexico. The generic and specific descriptions apply to *Milla biflora* in many respects but the following characters given for Diphalangium are at variance with those of Milla: (1) the perianth-segments one-nerved, longer than the tube, (2) stamens inserted in two series, diadelphous, three coherent at the base, (3) capsule connate with the perianth-tube from the base up to the middle.

In the first instance above, the phrase is applicable to Milla if the tube is considered to be that free portion of the perianth-tube above the ovary (see discussion below) but the perianth-segments of Milla are clearly 3–5-nerved in dried specimens and do not agree unless Schauer considered the whole colored central band a single nerve. The second phrase is the most difficult to identify with Milla, for stamens of the latter are uniseriate, not diadelphous nor cohering at the base. In all specimens seen, the perianth-tube of Milla forms a hyaline usually split pouch about the capsule but is quite free except at the base, not as described above. The specific description, furthermore, states that the scape is scarcely half an inch long and even the smallest specimen of *Milla biflora* has a scape two inches long.

It is not impossible that Schauer erred in his interpretation of the specimens before him and redescribed *Milla biflora* but his reference to the relationship of Diphalangium near Milla and between that genus and Tristagma indicates that he was familiar with Milla and Cavanilles' plate is such that there should be no difficulty in associating specimens with it. To date, search for the type or isotype collections (*Aschenborn 30*) has been unsuccessful. Until authentic material can be seen it is advisable to leave Diphalangium as a *genus incertum*, clearly of this alliance but obscure in its exact relationship.

Examination of flowers of the species described as *Milla magnifica* showed that floral morphology in the genus has long been misinterpreted and the generic description above is at variance with that of Endlicher (Gen. Pl. 142, 1836), Baker (Journ. Linn. Soc. Lond. Bot. xi, 378, 1871), Watson (Proc. Amer. Acad. xiv, 240, 1879), Bentham and Hooker (Gen. Pl. iii, 799, 1883), and Krause (Engler & Prantl, Nat. Pflanzenfam. Aufl. 2, 15a, 325, 1930), all of whom considered the flowers of *Milla biflora*,

then the only species known, long-pedicellate, perhaps through misinterpretation or neglect of Cavanilles' slightly ambiguous phrase "Florum pedunculi, magna parte corollæ tubo vestiti, sunt tripollicares . . .". Contrary to the above writers, the flowers of *Milla biflora* are sessile, and the "pedicel" is in reality an elongate perianth-tube adnate at three points to flanges of a long gynophore and, in *M. biflora*, completely fused with it toward the base (Fig. 105Bc). Above the base of the ovary the tube becomes slightly ventricose and free and is then the "tube" of Baker and others.

Baker, in his Revision of the Genera and Species of Herbaceous Capsular Gamophyllous Liliaceæ (op. cit. 378–387) adopted a broad concept of the genus, adding or transferring to it 22 species. Later students cited above did not maintain this treatment nor did Baker himself in a later study (Gard. Chron. ser. 3, xx, 687, 1896) and the genus remained monotypic until 1943. In that year a second species closely related to *M. biflora* but with distinctly pedicellate flowers was described by I. M. Johnston as *Milla Bryanii* (Journ. Arnold Arb. xxiv, 90). Here the flowers were described as ". . . 16–18 cm. longis 1–5 (saepe 2) cm. longe pedicellatis" and apparently correctly interpreted although no mention was made of the stipitate ovary. Four new species also have pedicellate flowers and the six now known may be distinguished as follows:[2]

1. Perianth blue; stamen-filaments columnar, abruptly truncate at the apex with a setiform prolongation to the anther; perianth-tube short, 2.2–2.5 cm. long..... 6. *M. Mortoniana*

1. Perianth white with green stripes, pink or white flushed with pink, the stamen-filaments subulate, gradually narrowed to the anther.

2. Flowers sessile but the perianth-tube 6–17–(22) cm. long or more, completely united with the gynophore for 1–5 cm. at the base and the flowers sometimes pseudopedicellate; perianth white with green stripes; stamen-filaments shorter than the anthers: leaves generally shorter than the scape, slender and grass-like..... 4. *M. biflora*

2. Flowers pedicellate; stamen-filaments (except *M. delicata*) prominent and exserted, as long as to twice as long as the anthers; perianth-tube with lacunæ between flanges of the gynophore to the base.

3. Umbel 15–30-flowered; perianth white with green stripes; anthers blue: leaves longer than the scape, stout, markedly fistulose..... 1. *M. magnifica*

3. Umbel 1–8-flowered; anthers white or yellowish: leaves generally shorter than the scape, slender and grass-like.

4. Perianth-tube 4 cm. long or more; stamen-filaments as long as to twice as long as the anthers.

5. Perianth pink or white flushed with pink, the tube 4.3–5 cm. long..... 2. *M. rosea*

5. Perianth white with green stripes, the tube 10–15 cm. long.. 3. *M. Bryanii*

4. Perianth-tube 1.5–1.6 cm. long; stamen-filaments shorter than the anthers: flowers pink..... 5. *M. delicata*

[2] Gentry (Carn. Inst. Wash. Publ. 527, 90, 1942) mentions a Milla that may represent yet another species but the specimen (*Gentry 2659a*) is in storage and not available for study at present.

† 1. **Milla magnifica,** spec. nov. Fig. 108.

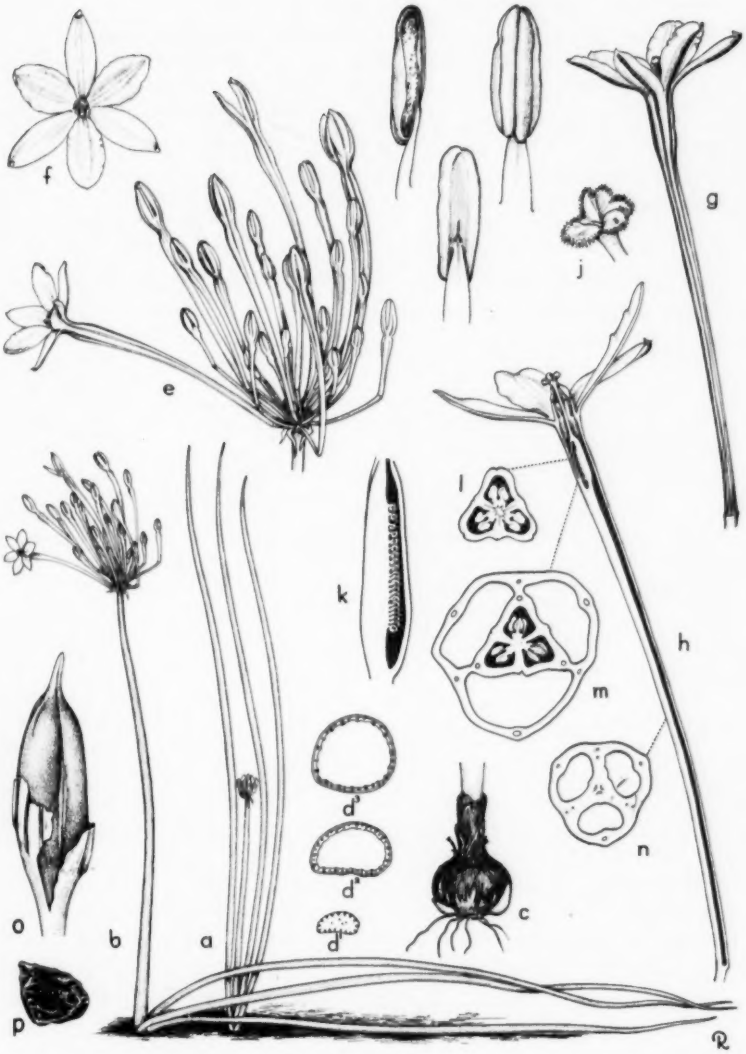
Cormus 3.5 cm. diam. 2.5 cm. altus: folia 3 teretia fistulosa ad 1 m. longa 12 mm. diam.: scapus erectus ad 5.5 dm. altus bracteis deltoideis 10–15 mm. longis, umbellam 15–30-floratam gerens: flores albi pedicellati pedicellis 1–5 cm. longis tubo 13–15 cm. longo ad basin 4 mm. diam. ad faucem ventricosam 6–7 mm. diam. segmentis quinquenervatis 30–32 mm. longis 10–13 mm. latis; stamina exserta filamentis 4 mm. longis antheris 3 mm. longis; ovarium 10–15 mm. longum stipite 11.5 cm. longo: fructus ellipsoidalis 4.2 cm. altus.

Corm 3.5 cm. in diameter, 2.8 cm. high with a collar 2.4 cm. high: leaves 3, erect, becoming prostrate at anthesis, solid and channeled adaxially for 4 cm. at base, subterete or terete and fistulose above, glaucous becoming dark green in age, to 1 m. long, 10–12 mm. in diameter, the cells filled with raphids 0.2–0.4 mm. long: scape hollow above the base, to 5.5 dm. high, 11 mm. in diameter at base, 5 mm. in diameter below umbel; spathe-bracts 10–15 mm. long, deltoid, acute, withered at anthesis; umbel 15–30-flowered, pedicels unequal, 1–5 cm. long, the outermost generally shortest: perianth-tube with lacunæ between flanges of the gynophore to the base, 13–15 cm. long, 4 mm. wide at base, 6–7 mm. wide at the slightly ventricose throat, white with 6 green stripes, segments not clawed, 3-grooved on inner surface with indistinctly 3-nerved green stripe on outside in vivo, distinctly 5-nerved in sicco, 30–32 mm. long, the outer 8–10 mm. wide, callous-tipped with entire margins, the inner 10–13 mm. wide, emarginate at apex with crisped margins; stamen-filaments subulate, exserted, 4 mm. long, smooth, white, anthers 3 mm. long, bluish at dehiscence, pollen white; ovary 10–15 mm. long on a gynophore 11.5 cm. long, glabrous, ovules ca. 40 to a locule, style 1.5 cm. long, scarcely exceeding the anthers, stigmas papillate on the margins, smooth at center: capsule ellipsoid, 4.2 cm. high, 11 mm. diameter; seeds black, shining, minutely granular.

Mexico: Guerrero; slopes above Río de los Sabinos near Los Sabinos, 36–38 km. from Iguala on road to Teloloapan; corms collected November 1949, flowered at Ithaca, New York, October 1951, *Moore 5974* (BH, holotype); same, October 1952, *Moore 6469* (US, paratype).

Milla magnifica is readily distinguished from all other species by the many-flowered umbel and the large, terete, fistulose leaves. These leaves are striking in several respects. Before flowering they stand erect with much the appearance of those of an onion. As the inflorescence matures they become prostrate from the base. Although apparently terete, close examination shows a slight flattening along the adaxial surface and comparison with living material of *Milla biflora* in the Bailey Hortorium garden showed essential homology. Leaves of the latter are often more numerous, shorter and grass-like, distinctly flattened with a prominent adaxial groove. Sections, however, showed the same general pattern of a solid base with a small but distinctly hollow center above.

Seedling corms at the end of one year's growth provide the basis for an understanding of the leaf and especially of the tunics of the corm.



108. MILLA MAGNIFICA. a, habit in bud ×1/9; b, habit in flower ×1/9; c, corm ×⅓; d, leaf cross-sections, basal, median, subapical, ×1; e, umbel ×⅓; f, flower face view ×½; g, flower exterior view ×½; h, flower longitudinal section ×⅔; i, stamens ×3; j, stigma ×3; k, ovary longitudinal section ×2; l,m,n, ovary and perianth-tube cross-sections ×4; o, fruit ×1; p, seed ×3.

Only one green leaf is produced the first year. This leaf is about 1 dm. long, 1 mm. wide and terete except at the top of the corm where it is slightly grooved and infolded in one side. The base is thin and completely enfolds the corm. In the thin seedling leaves the basic pattern of the tunic formed by the persistent bases is recognizable when in old corms the coats are so thickened as to prevent observation. The tunic consists of innumerable thick more or less rectangular cells arranged in nearly vertical or somewhat interlocking lines, the lateral walls of these cells eventually become thickened and continuous, forming the parallel fibers of the old and outermost tunics in the mature plant. There is no evidence of reticulate fibers. Enclosed within the outer leaf and attached slightly above the mid-point of the corm is a second but rudimentary leaf about 7 mm. long that is obliquely truncate and open at the apex. Within this a third shorter and entirely closed rudiment is attached near the top of the corm and sheaths the developing leaf-buds.

Milla magnifica should make an attractive addition to the already long list of cultivated Amaryllidaceæ. The flowers are intensely fragrant, remain open two to three days and appear singly or two to four at once over a period of a month. The time of flowering in the native habitat cannot be stated. When collected in November 1949 only leaf remains were evident.

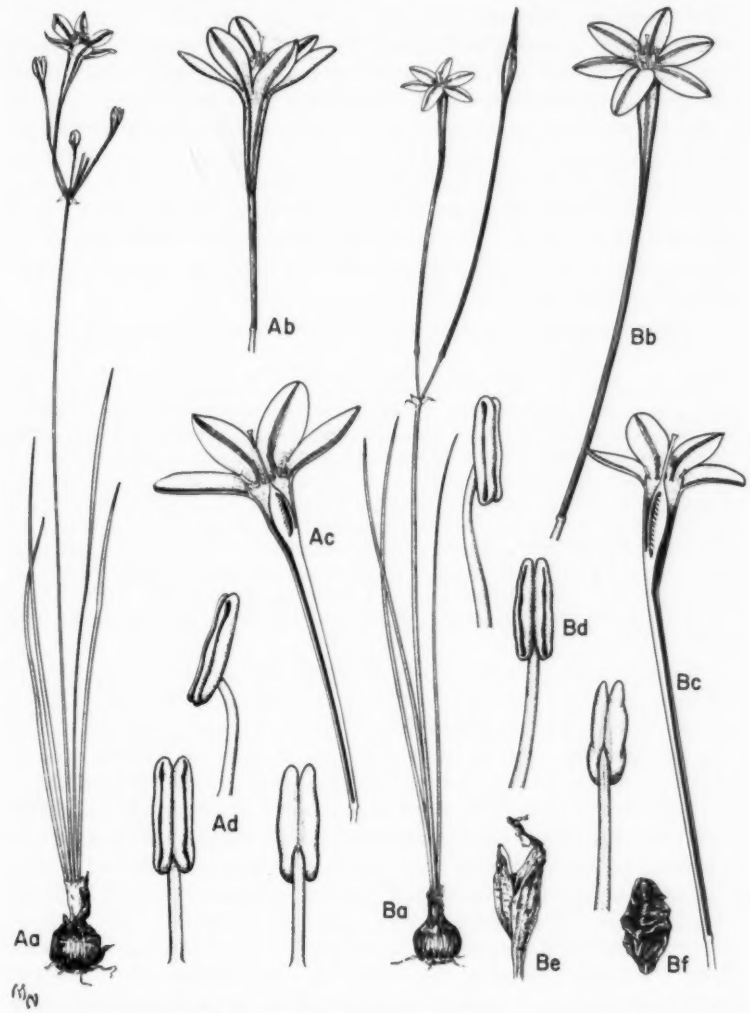
The description and illustration have been taken from the more vigorous of two corms that flowered in the greenhouse at Cornell University in 1951. The second was inferior in size and number of flowers, the last due to abortion of many central buds. The plants are self-sterile with protandrous flowers, the stigmas remaining appressed until late in the second day of flowering. When flowers of different plants are cross-pollinated, seed forms readily and vegetative reproduction is by one or more cormlets produced annually at the base of or on short rhizomes from the parent corm.

† 2. **Milla rosea,** spec. nov. Fig. 109A.

Cormus 2 cm. diam.: folia 5–7 graminiformia 1.5–3 dm. longa 1–2 mm. lata: scapus 1.8–3.2 dm. altus 1.5–2 mm. diam. bracteis 5 mm. longis umbellam 5–6-floratam gerens: flores rosei pedicellati pedicellis 0.8–2.5 cm. longis tubo 4.3–5 cm. longo ad basin 1 mm. diam. ad faucem 5–6 mm. diam. gradatim expanso segmentis patentibus 1.8–2 cm. longis; stamina exserta filamentis 3–4 mm. longis antheris 3 mm. longis; ovarium 7 mm. longum stipite 3.5–4 cm. longo: fructus ignotus.

Corm 2 cm. in diameter with a collar 2 cm. high: leaves 5–7, grass-like, 1.5–3 dm. long, 1–2 mm. wide, minutely hyaline-denticulate along the nerves: scape 1.8–3.2 dm. high, 1.5–2 mm. in diameter, smooth or minutely roughened at the base; spathe-bracts 4–5 mm. long; umbel 5–6-flowered: flowers pink or white flushed with pink, on pedicels 0.8–2.5 cm. long, the perianth-tube 4.3–5 cm. long, with lacunæ between flanges of the gyno-

phore to the base, 1 mm. wide at the base, gradually expanded upward without constriction to the throat and there 5–6 mm. wide, the segments obscurely 5-nerved, 1.8–2 cm. long, 5 mm. wide, stamen-filaments subulate, 3–4 mm. long, anthers yellow, 3 mm. long; ovary glabrous, 7 mm. long on



109. MILLA ROSEA. a, habit ×⅓; b, flower exterior view ×⅔; c, flower longitudinal section ×1; d, stamens ×6. B, MILLA BRYANII. a, habit ×⅓; b, flower exterior view ×⅔; c, flower longitudinal section ×⅔; d, stamens ×8; e, fruit ×1; f, seed ×3.

a gynophore 3.5–4 cm. long, ovules ca. 20 to a locule, the style 7 mm. long, exceeding the anthers: fruit and seed not seen.

Mexico: Nuevo León; Cerro del Obispado, N.W., Monterrey, alt. 1600 m., October 26, 1946, *Lacás 91* (F, holotype); same locality, September 1, 1947, *Lacás 469* (F, paratype).

Milla rosea is related to *M. Bryanii*, differing in the pink or white and pink-flushed flowers with much shorter perianth-tube. The two specimens examined are so mounted that dissection of mature flowers was impossible without destroying the material and living plants may show further distinctions especially with regard to details of the shape of the flowers not readily observed in herbarium specimens. Characters of the ovary have been drawn from an unexpanded but well-matured bud. No notes regarding color of the flowers were given by the collector but flowers of the holotype and paratype are both flushed with pink, the color being much stronger and almost red in bud.

3. **Milla Bryanii,** I. M. Johnston, in Journ. Arnold Arb. xxiv, 90 (1943). Fig. 109B.

Corm 1.5–2 cm. high with a collar to 1.5 cm. high: leaves 3–5, 2–4 dm. long, 1–3 mm. wide, narrowly linear, revolute, canaliculate above, slightly rounded below, green: scape 2–4.5 dm. high; spathe-bracts 5–8 mm. long; umbel 1–6-flowered: flowers white with green stripes, on pedicels 1.5–5.5 cm. long, the perianth-tube 10–15 cm. long with lacunæ between flanges of the gynophore to the base, 1.5 mm. wide at base, 5–6 mm. wide at the often more or less constricted throat, segments 13–16 mm. long, 4.5–6.6 mm. wide, indistinctly 5-nerved; stamen-filaments exserted, 4–5 mm. long, subulate, anthers yellow, 2.5 mm. long; ovary ca. 10 mm. long on a gynophore 9–14 cm. long, minutely trichomatous at the apex and base of style, ovules 26–30 to a locule, style exceeding the anthers: capsule 2 cm. long, 7 mm. wide; seeds numerous, black, shining.

Mexico: Coahuila; north-facing mountain side, western base of Picacho del Fuste, northeasterly from Tanque Vaionetta, about lat. 27°34′N., August 23–25, 1941, *Johnston 8364* (GH, paratype); rocky slopes and crest of limestone ridge at head of canyon, Cañon del Cuervo Chico, a large canyon cut into the western escarpment of the tableland about 16 km. north of Cuesta Zozaya, about lat. 27°25′N., August 27, 1941, *Johnston 8529* (GH, holotype); southwestern end of the Sierra de la Fragua, 1–2 km. north of Puerto Colorado, September 2, 1941, *Johnston 8777* (GH, paratype); vicinity of "La Cueva" in Corte Blanco fork of Charretera Canyon, Sierra de la Madera, 5300–6500 feet, September 11–15, 1941, *Johnston 9123* (GH, paratype); Municipio Cuatro Cienegas, Cañon del Agua, Sierra de la Madera, September 7, 1939, *Muller 3203* (GH, UC, paratypes); vicinity of Rancho La Botica, base of the Sierra de las Margaritas along the western side of Valle de Delicias, October 5, 1942, *Stewart 2848* (GH); same locality 1 km. north, October 8, 1942, *Stewart 2898* (GH).

This species, known by the vernacular name Cebollin, is allied to *Milla rosea* in the few and pedicellate flowers but its closest relationship is probably with *M. biflora* from which it differs only in the presence of pedicels and better developed stamen-filaments. The stamen-filaments are described as lamellate by Johnston, but when expanded in boiling they become more nearly terete with hyaline margins and an opaque central bundle similar to the filaments in *M. rosea* and *M. magnifica*. In all species, the dried filament has a prominent clear margin that sometimes becomes wrinkled and contorted in drying.

4. **Milla biflora,** Cav. Icon. Pl. ii, 76, t. 196 (1793). Fig. 105B.

Millea biflora, (Cav.) Willd. Sp. Pl. ii, 62 (1799).

Askolame biflora, (Cav.) Raf. Fl. Tellur. ii, 12 (1836) [1837].

Corm 1–3 cm. in diameter, 1–2 cm. high with collar 1.5–4 cm. high: leaves 2–7–(10), (0.5)–1–5–(7.5) dm. long, 1–3 mm. wide, narrowly linear, canaliculate above and rounded below or sometimes subterete with minutely hyaline-denticulate nerves: scape 0.5–3.7 dm. high, 1–3 mm. in diameter, smooth or minutely roughened toward the base; spathe-bracts 5–12 mm. long or rarely more: umbel 1–6–(8)-flowered, the flowers sessile, fragrant, the perianth-tube white with green stripes, smooth or sometimes scabrellous toward the base outside, 6–18–(22) cm. long with lacunæ between the flanges of the gynophore to within 0.5–5 cm. of the base and then the tube and gynophore fused in a pseudopedicel, 1–2 mm. wide at the base, 3–6 cm. wide at the somewhat constricted throat, segments distinctly narrowed into a short claw at the base, 15–35–(40) mm. long, the outer 3–5–(7)-nerved, 5–10 mm. wide, the inner 3–(5)-nerved, 8–17 mm. wide, sometimes flushed with lavender on the outer margins; stamen-filaments very short or more rarely to 3 mm. long, subulate, smooth, the anthers lanceolate, sagittate at the base, generally subsessile, yellow, 2–6–(8) mm. long; ovary 5–8–(12) mm. long on a gynophore 5.5–15.5–(20) cm. long, glabrous or only slightly trichomatous at the apex, ovules ca. 30 to a locule, style distinctly exceeding the anthers, smooth or sometimes roughened: capsule to 2.5 cm. long, 1 cm. wide; seeds black, dullish with relatively coarse granulation.

Arizona and New Mexico south through the mountains to northern Guatemala, principally in volcanic areas, the following representative:

United States: Arizona, Cochise, Pima and Santa Cruz counties; Shaw's Ranch, Chiricahua Mountains, 5500 feet, August 26, 1907, *Blumer 1628* (F, GH, NY, US); near head of Carr Canyon, Huachuca Mountains, 7100 feet, September 9, 1944, *Darrow, Phillips, Gould & Pultz 1460* (UC); south side of Santa Rita Mountains above the Dink Parker Ranch on the Mary Kane Wash, 5500 feet, September 14, 1945, *Gould & Haskell 3291* (UC); Patagonia Mountains, September 15, 1929, *Harrison & Kearny 6063* (GH); mountain valleys between San Pedro and Santa Cruz (San Pedro Valley between Benson and the Huachuca Mountains) September

12, 1851, *Wright 1913* (GH, NY, US): New Mexico; Animas Valley, October 2, 1903, *Mearns 2513* (US).

Mexico: Sonora; Pinal, Sierra Charuco, September 9, 1935, *Gentry 1694* (F, GH); Cananea, August 20-September 1, 1914, *Murdoch s.n.* (F); Cañon de Huépari, north of Aribabi, loop of the Río de Bavispe, 4300 feet, September 2–3, 1939, *White 2652* (GH); El Rancho del Roble, northeast of El Tigre, region of the Río de Bavispe, 6000 feet, September 2–13, 1941, *White 4263* (GH): Chihuahua; Sierra Canelas, Río Mayo, 5000 feet, October 1, 1935, *Gentry 1903* (UC, US); Los Cascarones, Río Mayo, September 11, 1936, *Gentry 2659* (GH); La Cienegita, Río Mayo, September 19, 1936, *Gentry 2812* (F, GH, UC, US); 10–14 miles west of Hidalgo de Parral, ca. 2000 m., September 11, 1948, *Gentry 8263* (GH, US); vicinity of Pirámide, about lat. 28°45′N., August 11–12, 1941, *Johnston 8150* (GH); Mojarachic, August 23, 1938, *Knobloch 5502* (F); Río Gavilán, 7 miles SW of Pachuco, ca. 6000 feet, August 15, 1948, *Leopold 200* (UC); Majalca, August 20, 1935, *LeSueur Mex-110* (F, GH, UC); 31 miles SE of Jiminez, September 16, 1939, *Muller 3338* (GH, UC); plains near Chihuahua, August 1885, *Pringle 660* (F, GH, US); vicinity of Rancho Encampanada, a large canyon in the igneous Sierra Hechiceros near the Coahuilan boundary, 10–12 km. northeast of Rancho Hechiceros, September 30, 1940, *Stewart 199* (GH); vicinity of the playas just below the high ridgecrests at the northwestern end of the Sierra del Diablo, about lat. 27°20′N., July 29, 1941, *Stewart 965* (GH); 4 km. east of Tepopote, September 22, 1942, *Stewart 2365* (GH); near Colonia Garcia, 8000 feet, July 16, 1899, *Townsend & Barber 132* (GH, NY, UC, US); Carretas, border of Chihuahua and Sonora, 4800 feet, August 26–28, 1939, *White 2569* (GH): Coahuila; gravelly flat at head of canyon, Sierra de Hechiceros, Cañon de la Madera, September 15, 1940, *Johnston & Muller 1298* (GH): Sinaloa; Cofradia, vicinity of Culiacán, October 21, 1904, *Brandegee s.n.* (UC); Quebrada de Mansana, Sierra Surotato, 4000–4500 feet, September 10–14, 1941, *Gentry 6521* (GH, NY): Durango; city of Durango and vicinity, April–November 1896, *Palmer 355* (GH, NY, UC, US); Otinapa, July 25—August 5, 1906, *Palmer 405* (F, GH, NY, UC, US); El Salto (Aserraderos), 2570–2600 m., August 28, 1934, *Pennell 18327* (US); Indé, November 1927, *Reko 5323* (F): Zacatecas; crest 4 miles east of Noria de Angeles, road from Zacatecas east to San Luis Potosí (via Pinos), 7400 feet, September 6–8, 1938, *Johnston 7462* (GH): Nayarit; trail from Yxtlan to San Marcos, 1100 m., September 29, 1926, *Mexia 842* (F, GH, NY, UC, US); foothills between Acaponeta and Pedro Paulo, August 2, 1897, *Rose 1953* (US); between Pedro Paulo and San Blascito, August 4, 1897, *Rose 3334* (US); between Santa Gertrudis and Santa Teresa, August 8, 1897, *Rose 3380* (US): Aguascalientes; Aguascalientes, 1839, *Hartweg 233* (GH, NY): San Luis Potosí; Alvarez.

July 13–23, 1904, *Palmer 216* (GH, US); region of San Luis Potosí, 6000–8000 feet, 1878, *Parry & Palmer 884* (GH, US) and *884 1/2* (F, NY, US): Jalisco; fields in Hacienda San Marcos, July 12, 1905, *Goldsmith 14* (GH, US); Río Blanco, September 1886, *Palmer 529* (GH, NY, US); Guadalajara, July 9, 1899, *Rose & Hough 4982* (US): Querétaro; near San Juan del Río, August 17, 1905, *Rose, Painter & Rose 9523* (US); near Querétaro, August 20–23, 1906, *Rose & Rose 11181* (NY, US): Hidalgo; Real del Monte, *Coulter 1545* (GH); Los Ollos near Jacala, August 13, 1937, *Edwards 764* (F); west slopes of Los Organos de Actopan, 2800 m., November 17, 1946, *Moore 2035* (BH, GH); field atop hill near Cerro Colorado, between Zoquital and head of descent into Barranca de Metztitlán, ca. 2000 m., July 31, 1948, *Moore & Wood 4175* (BH); dry rocky hills near Hacienda El Abra between Tulancingo and Acaxochitlán, ca. 2300 m., September 6, 1948, *Moore & Wood 4880* (BH); mountain slopes, Pachuca, September 1905, *Purpus 1838* (F, US): Colima; Hacienda San António, 1200 m., September, 1923, *Reko 4831* (US): Michoacán; Punguato, vicinity of Morélia, 2000 m., August 18, 1910, *Arsène 6948* (GH, US); District Coalcomán, Coalcomán, September 7, 1938, *Hinton 12147* (GH, NY, US); District Zitácuaro, Zitácuaro-San José Purua, 1700 m., August 22, 1938, *Hinton 13129* (CU, NY, US); District Coalcomán, Sierra Naranjillo, August 23, 1939, *Hinton 15133* (GH, NY, US); Apatzingán, Tancitaro region, August 23, 1941, *Leavenworth & Hoogstraal 1781* (F); Pátzcuaro, November 1, 1895, *C. & E. Seler 1262* (GH): Guerrero; District Coyuca, Balderrama, August 26, 1934, *Hinton 6500* (F, NY, US); 10 miles NE of Taxco, 5800 feet, July 10, 1940, *Hitchcock & Stanford 7089* (GH, UC); District Mina, Zihuaqueo-Santana, 1350 m., August 25, 1936, *Hinton 9329* (GH, NY, US): México; Tlalpujahua, July 1828, *Graham 359* (GH, US); District Temascaltepec: Ixtapan, 1000 m., July 23, 1932, *Hinton 1189* (F, GH, NY, US); Timbres, 1900 m., August 3, 1932, *Hinton 1235* (NY, US): Distrito Federal; Guadelupe, August 10, 1865–66, *Bourgeau 696* (GH, US); Pedregal near San Angel, August 16, 1929, *Mexia 2732* (F, NY, UC): Morelos; slopes about Cuernavaca, 5000 feet, June 18, 1904, *Pringle 13224* (CU, F, GH, US); Yautepec, July 1905, *Rose, Painter & Rose 8566* (GH, NY, US: Puebla; vicinity of Puebla, Acatzinco, District Tepeaco, 1900 m., August 1907, *Amable 1599* (US); vicinity of Puebla, entre les haciendas Santa Bárbara et Cristo, sur l'Alseseca, 2150 m., June 27, 1907, *Arsène 1537* (US); San Baltázar, July 3, 1909, *Nicolas 36* (F); El Riego-Tehuacán, June–July 1905, *Purpus 1838* (UC); vicinity of San Luis Tultitlanapa, July 1908, *Purpus 3470* (F, UC): Oaxaca; El Fortín, 1650 m., July 10, 1896, *Conzatti 218* (GH); hills of Oaxaca, 1700 m., July 1897, *Conzatti 352* (F, GH); District Nochistlán, Huanchilla, 2200 m., 1924, *Conzatti 4581* (US); Tenango, 7000 feet, July 6, 1895, *Smith 554* (GH): Chiapas; between

San Richardo and Ocozucuantla, 2600–3300 feet, August 18, 1895, *Nelson 2984* (US).

Guatemala: Huehuetenango; pastures near Huehuetenango, 1900 m., September 23, 1944, *Melhus & Goodman 3556* (F); rocky dry slopes above San Ildefonso Ixtahuacán, 1600–1700 m., August 15, 1942, *Steyermark 50660* (F, US); between Nentón and Las Palmas, via Yalisjao, Rincón Chiquite, Chiaquial, Guaxacaná, in Sierra de los Cuchumatanes, 800–1200 m., August 30, 1942, *Steyermark 51624* (F): Quiché; without locality, 1942, *Aguilar 1446* (F).

Although the first species described in the genus, *Milla biflora* is by no means the most typical. The nearly sessile anthers and reduced number of sessile flowers indicate an advance over the pedicellate species with prominent stamen-filaments. The perianth-tube is generally completely united to the gynophore toward the base and the flowers often might be termed pseudopedicellate. That they are not truly pedicellate is best observed in fruiting plants where the articulation between flower and pedicel of pedicellate species becomes enlarged forming a horny rim lacking in *Milla biflora* which develops no more than a slight swelling.

The presence of *Milla biflora* principally in volcanic regions has been discussed previously. It generally occurs on open slopes or grasslands as scattered individuals or sometimes, as in the lava flows near Mexico City, in relative abundance. Various local names are employed, among them Azucena, Azucena del Campo, Azucena Silvestre, Estrella, Flor de San Juan, Flor de San Nicolas, Lilia Cimarón in Mexico and Jacinto de Monte in Guatemala.

The species is polymorphic throughout its wide range. Variation, especially in the size of flowers, is the most extreme in the whole Milla complex with a range from dwarf 1-flowered plants with the perianth-tube only 6 cm. long to very robust 5–6-or rarely 8-flowered individuals with perianth-tubes up to 18 or very rarely 22 cm. long. In fundamental characters and proportions, however, there is relative stability and no marked segregations can be clearly defined in subspecific taxa.

The perianth-segments, at least the inner, are generally 3-nerved and the anthers are subsessile on short filaments not or only slightly longer than the basal lobes of the anthers. Collections from southern Mexico and Guatemala tend to have 5–7-nerved outer perianth-segments and stamens with noticeable filaments up to 3 mm. long but maintaining more or less relative proportions to the longer anthers that may reach 6 mm. in length. *Conzatti 352* from Oaxaca, *Nelson 2984* from Chiapas and *Steyermark 50660* from Guatemala are expressions of this tendency. I find no justification for considering them apart on the basis of present evidence and the possible causes for these or other variations can be no more than subjects of conjecture until more adequate studies are made.

† 5. **Milla delicata,** spec. nov. Fig. 110A.

Cormus ignotus: folia graminiformia ca. 3 dm. longa 1–1.5 mm. lata: scapus 3.3–4.5 dm. altus 1–2 mm. diam. bracteis 4–8 mm. longis umbellam 4–8-floratam gerens: flores rosei pedicellati pedicellis 1.2–2 cm. longis tubo 1.5–1.6 cm. longo ad basin 1 mm. diam. ad faucem 4–5 mm. diam. segmentis erectis (?) 7 mm. longis 3.5–5 mm. latis; stamina vix exserta filamentis subulatis brevibus 1.5 mm. longis antheris 2.5–3 mm. longis; ovarium 4 mm. longum stipite 9–10 mm. longo: fructus ignotus.

Corm unknown: detached leaves slender, grass-like, ca. 3 dm. long, 1–1.5 mm. wide, the nerves minutely hyaline-denticulate: scape 3.3–4.5 dm. high, 1–2 mm. in diameter; spathe bracts 4–8 mm. long: umbel 4–8-flowered; flowers pink (fide Hinton), on pedicels 1.2–2 cm. long, the perianth-tube 1.5–1.6 cm. long with lacunæ between the flanges of the gynophore to the base, 1 mm. wide at the base, 4–5 mm. wide and ventricose about the ovary, the segments erect and somewhat incurved at the apex (?), 7 mm. long, 3.5–5 mm. wide, 3-nerved in a stout central band; stamens scarcely exserted, the filaments subulate, 1.5 mm. long, the anthers yellow, 2.5–3 mm. long; ovary glabrous, 4 mm. long on a gynophore 9–10 mm. long, ovules 18–20 to a locule, the style and unexpanded stigma included in the perianth-tube: fruit and seed unknown.

Mexico: Guerrero; District Mina, oak and pine forest, Laguna, 1900 m., November 29, 1936, *Hinton 9920* (US, holotype).

Milla delicata resembles *M. Mortoniana* in the several-flowered umbel of small pedicellate flowers. The dimensions of the latter, however, are smaller, the color is pink rather than blue and the scarcely exserted stamens have very short subulate filaments similar in appearance to those of *M. biflora*. It has the smallest flowers known in the genus and in spite of the pink color bears little resemblance to *M. rosea* nor is it likely to be confused with any other known species. Rather it has been confused with *Bessera elegans* and had been so named.

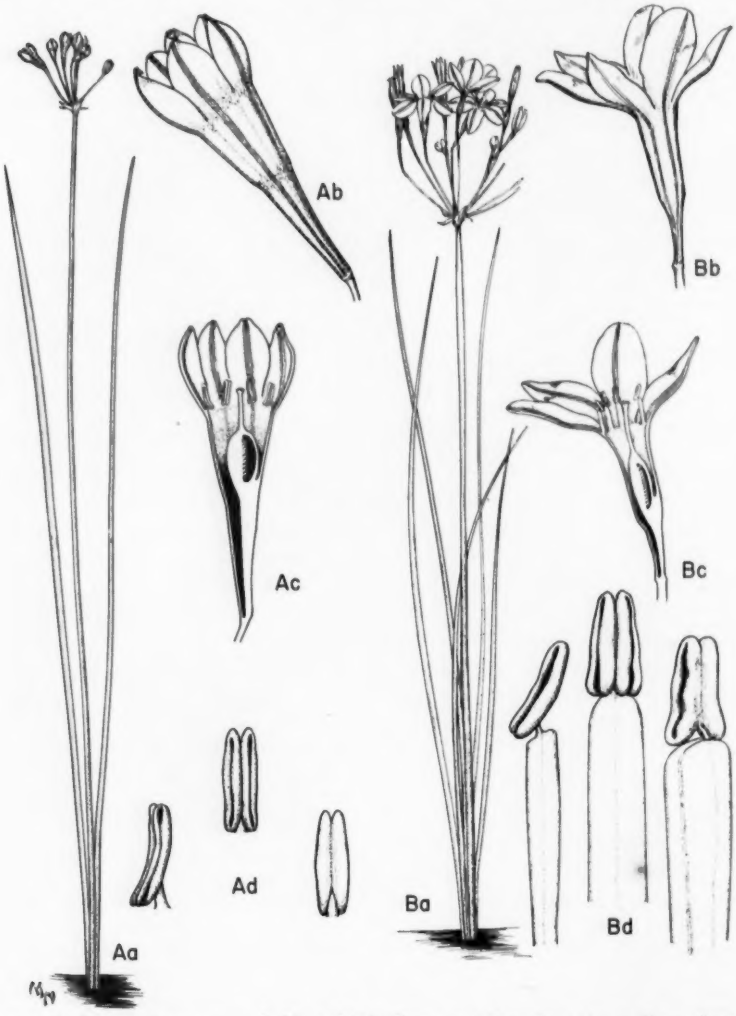
The type and only collection seen has three detached scapes with several flowers. The perianth-segments are appressed and probably erect or perhaps even somewhat hood-like at anthesis superficially appearing immature. One flower, obviously past anthesis, is no larger than the rest and the segments of apparently mature flowers remain erect when boiled for dissection.

† 6. **Milla Mortoniana,** spec. nov. Fig. 110B.

Cormus ignotus: folia ca. 5 graminiformia 2.5–3.5 dm. longa 1–2 mm. lata: scapus 2.6–3.5 dm. altus 2 mm. diam. bracteis 7–8 mm. longis umbellam 4–13-floratam gerens: flores cærulei pedicellati pedicellis 3–3.5 cm. longis tubo 2.2–2.5 cm. longo ad basin 1 mm. diam. ad faucem 1–2 mm. diam. segmentis trinervatis 15–16 mm. longis 6–11 mm. latis; stamina exserta filamentis columnaribus truncatis 2 mm. longis antheris 1 mm. longis; ovarium 5 mm. longum stipite 1.3–1.6 cm. longo: fructus ignotus.

Corm unknown, fragments of the tunic and collar 4 cm. high with minute parallel fibers: leaves about 5, grass-like, 2.5–3.5 dm. long, 1–2

mm. wide, equalling or exceeding the scape, several-nerved, the nerves minutely hyaline-denticulate: scape 2.6–3.4 dm. high, 2 mm. in diameter, smooth; spathe-bracts 7–8 mm. long, linear-lanceolate: umbel 4–13-flowered; flowers blue (fide Hinton) on pedicels 3–3.5 cm. long, the perianth-



110. A, MILLA DELICATA. a, habit ×⅓; b, flower exterior view ×2; c, flower longitudinal section ×2; d, stamens ×8. B, MILLA MORTONIANA. a, habit ×⅓; b, flower exterior view ×1; c, flower longitudinal section ×1; d, stamens ×8.

tube 2.2–2.5 cm. long with lacunæ between flanges of the gynophore to the base, 1 mm. wide at the base, 2 mm. wide about the ovary, again narrowed at the throat, segments spreading, 3-nerved, 15–16 mm. long, the outer 6–7 mm. wide, the inner 8–11 mm. wide; stamens with conspicuous filaments 2 mm. long, 0.5 mm. wide, columnar and abruptly truncate at the apex with a setiform prolongation to the oblong or (when dry) deltoid anthers, anthers 1 mm. long when dry, yellow; ovary 5 mm. long on a gynophore 1.3–1.6 mm. long, ovules ca. 20 to a locule, the style with unexpanded stigma 3 mm. long: fruit and seed not seen.

Mexico: Guerrero; District Mina, edge of cliffs, Tierras Blancas, 1400 m., October 19, 1936, *Hinton 9725* (GH, holotype, NY, US, isotypes).

This remarkable species is named for Mr. C. V. Morton of the United States National Herbarium who had indicated it as new and who has kindly consented to its publication here. The blue flowers, relatively short perianth-tube and unusual stamens distinguish it from all other species in the genus.

Living material is necessary for adequate characterization of leaf and scape but the leaves of dried specimens appear to be terete and hollow as does the scape. The corm has not been seen but the isotype at the United States National Herbarium has fragments of the tunics and collar similar to other Millas and enclosing five leaves.

EXCLUDED SPECIES

The following species of Milla are excluded from the genus. When definite disposition has been made recently, the authority for such disposition is given except when the species is the type of a genus. The remaining species from Chile and Argentina have two spathe-valves that are connate basally and apparently belong to the as yet insufficiently studied genera Ipheion and Nothoscordum.

andicola, (Kunth) Baker, in Journ. Linn. Soc. Lond. Bot. xi, 381 (1871) = **Nothoscordum andicola**, Kunth fide Macbride, Fl. Peru, i, 620 (1936).

aurea, (Lindl.) Baker, in Journ. Linn. Soc. Lond. Bot. xi, 386 (1871) = Nothoscordum sp.[2]

bivalvis, (Lindl.) Baker, in Journ. Linn. Soc. Lond. Bot. xi, 386 (1871).

bonariensis, Gillies ex Baker in syn. (*Milla uniflora*), in Jour. Linn. Soc. Lond. Bot. xi, 382 (1871) = **Ipheion uniflorum**, (Grah.) Raf. cf. Stearn, in Gard. Chron. ser. 3, cxiv, 60 (1943).

borbonica, (Kunth) Baker, Fl. Maurit. 373 (1877) = **Nothoscordum inodorum**, (Ait.) Nichols. fide Beauverd, in Bull. Herb. Boiss. 2 ser. viii, 1004 (1908).

brevipes, (Kunze) Baker, in Journ. Linn. Soc. Lond. Bot. xi, 386 (1871).

capitata, (Benth) Baker, in Journ. Linn. Soc. Lond. Bot. xi, 381 (1871) = **Dichelostemma pulchellum**, (Salisb.) Heller, fide Hoover, in Amer. Midland Nat. xxiv, 468 (1940).

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[2] The combination *Nothoscordum aureum*, (Lindl.) Johnston & Parodi, in Rev. Fac. Agron. & Vet. Buenos Aires vii, 182 (1930) has been made for this species but is a later homonym of *N. aureum*, (Kellogg) Hook. in Bot. Mag. t. 5896 (1871) based on *Bloomeria aurea*, Kellogg. It is not unlikely that a name already established will be found to apply when the genus is monographed. For that reason no new name is proposed here.

cærulea, Scheele, in Linnaea, xxv, 260 (1852) = **Androstephium cœruleum,** (Scheele) Greene.

crocea, (Wood) Baker, in Journ. Linn. Soc. Lond. Bot. xi, 384 (1871) = **Triteleia crocea,** (Wood) Greene fide Hoover, in Amer. Midland Nat. xxv, 85 (1941).

grandiflora, (Lindl.) Baker, in Journ. Linn. Soc. Lond. Bot. xi, 380 (1871) = **Triteleia grandiflora,** Lindl. fide Hoover, in Amer. Midland Nat. xxv, 79 (1941).

hirtella, (Kunth) Baker, in Journ. Linn. Soc. Lond. Bot. xi, 385 (1871) = **Ipheion hirtellum,** (Kunth) Traub, fide Traub, in Plant Life, v, 50 (1949).

hyacinthina, (Lindl.) Baker, in Journ. Linn. Soc. Lond. Bot. xi, 385 (1871) = **Triteleia hyacinthina,** (Lindl.) Greene, fide Hoover, in Amer. Midland Nat. xxv, 92 (1941).

ixioides, (Ait. f.) Baker, in Journ. Linn. Soc. Lond. Bot. xi, 383 (1871) = **Triteleia ixioides,** (Ait. f.) Greene, fide Hoover, in Amer. Midland Nat. xxv, 88 (1941).

laxa, (Benth.) Baker, in Journ. Linn. Soc. Lond. Bot. xi, 384 (1871) = **Triteleia laxa,** Benth. fide Hoover, in Amer. Midland Nat. xxv, 88 (1941).

Leichtlinii, Baker, in Gard. Chron. ser. 3, iii, 234 (1875) and Bot. Mag. t. 6236 (1876).

macrostemon, (Kunth) Baker, in Journ. Linn. Soc. Lond. Bot. xi, 381 (1871) = **Nothoscordum inodorum,** (Ait.) Nichols. fide Beauverd, in Bull. Herb. Boiss. 2 ser. viii, 1004 (1908).

maritima, (Torr.) Wats. in Bot. King's Exped. 354 (1871) = **Muilla maritima,** (Torr.) Wats.

nivalis, (Poepp.) Baker, in Journ. Linn. Soc. Lond. Bot. xi, 383 (1871) = **Tristagma nivale,** Poepp.

patagonica, Baker, in Journ. Linn. Soc. Lond. Bot. xi, 382 (1871).

peduncularis, (Lindl.) Baker, in Journ. Linn. Soc. Lond. Bot. xi, 384 (1871) = **Triteleia peduncularis,** Lindl. fide Hoover, in Amer. Midland Nat. xxv, 81 (1941).

Poeppigiana, (C. Gay) Baker, in Journ. Linn. Soc. Lond. Bot. xi, 383 (1871).

porrifolia, (Poepp.) Baker, in Journ. Linn. Soc. Lond. Bot. xi, 386 (1871).

Sellowiana, (Kunth) Baker, in Journ. Linn. Soc. Lond. Bot. xi, 383 (1871) = **Ipheion Sellowianum,** (Kunth) Traub, fide Traub, in Plant Life, v, 50 (1949).

sessiliflora, Baker, in Journ. Linn. Soc. Lond. Bot. xi, 382 (1871).

setacea, Baker, in Journ. Linn. Soc. Lond. Bot. xi, 385 (1871).

subbiflora, (Colla) Baker, in Journ. Linn. Soc. Lond. Bot. xi, 385 (1871).

Tweediana, (Baker) Griseb. in Goett. Abh. xxiv, 318 (1879) = **Ipheion Tweedianum,** (Baker) Traub, fide Traub, in Plant Life, v, 50 (1949).

uniflora, Grah. in Edinb. Phil. Journ. 174 (1833) = **Ipheion uniflorum,** (Grah.) Raf. fide Stearn, in Gard. Chron. ser. 3, cxiv, 60 (1943).

violacea, (Kunth) Baker, in Journ. Bot. xii, 5 (1874).

vittata, Griseb., in Goett. Abh. xxiv, 318 (1879) = **Ipheion vittatum,** (Griseb.) Traub, fide Traub, in Plant Life, v, 50 (1949).

ARTICLE 13.
EXOTIC PALMS IN THE WESTERN WORLD.

By H. E. Moore, Jr.

A fascinating account of the Fairchild Tropical Garden Expedition of 1940 aboard the junk "Cheng Ho" has been given by Dr. David Fairchild who dedicated his book "To those who in the years to come may find in their gardens some plant which this expedition brought into the western world." [1]

Now, ten years after that dedication, some of these plants have reached maturity. Among them are a number of palms that were introduced as seeds. It has been my privilege to study some of these palms over a period of several years in an attempt to identify them and it is hoped that this may be but the first of several reports on them and on others that are enriching our cultivated flora.

To establish the identity of species from the Molucca Islands comparison of cultivated and authentic wild material was desired. The type specimens of the four species of Drymophlœus and Siphokentia from the Moluccas were destroyed when the herbarium of the Berlin Botanical Garden was burned during the war. Thanks to the Keeper of the Herbarium, Herbarium Bogoriense, Bogor, Indonesia, and the Director of the Rijksherbarium, Leiden, Netherlands, duplicate specimens were located in the herbarium at Bogor and forwarded for study. Abbreviations for this and other herbaria in specimen citations are those of Index Herbariorum (Reg. Veg. ii, 106, 1952).

The stimulating contact with the many persons who are actively concerned with the introduction and establishment of new plants in Florida and the Bahama Islands has added to the pleasure of working with these palms and I am indebted to these enthusiasts for unstinting assistance. Especial acknowledgment is due Dr. David Fairchild of Coconut Grove, Florida, and Mr. and Mrs. A. C. Langlois of Nassau, Bahama Islands, for their patience in supplying series of specimens, both dried and in liquid, and for their hospitality during visits to study living plants. Mrs. Anne Archbold has similarly extended the hospitality of her home and garden in Nassau during the course of this study. For such work as was done in the spring of 1952 I am also indebted to the American Philosophical Society for a grant of money. The plates accompanying this article are the work of Marion Ruff (Mrs. Thomas Sheehan) with some additional figures by Miss Mitsu Nakayama.

[1] Fairchild, D. F., Garden Islands of the Great East, Charles Scribner's Sons, New York 1943. Quoted with permission of the publishers.

DRYMOPHLŒUS

Many of the palms described by the Dutch botanist Rumphius in his Herbarium Amboinense, a classic pre-Linnæan work on Malayan botany, were later given binomial names by others in accord with the Linnæan system of plant nomenclature. Of these plants some remain questionable today. Others, however, were well described and illustrated and can be placed with reasonable certainty.

Among the latter is *Drymophlœus olivæformis* based on Saguaster minor of Rumphius. Seeds of this species and of another allied to it were collected in 1940 by Hugo Curran and introduced into cultivation as *Fairchild Tropical Garden Expedition numbers 331 and 402*. Trees grown from these two collections are now flowering and fruiting in Florida and the Bahamas. Because they are new to cultivation in this hemisphere and because there have been certain misconceptions regarding them, they will be discussed in some detail here.

DRYMOPHLŒUS, Zipp. in Algemeene Konst-en Letterbode, xix, 294 (1829); Flora, xii, 285 (1829); Miq. De Palm. Arch. Ind. 4 (1868).

Solitary single-stemmed monœcious small trees: leaves regularly pinnate with tubular sheaths forming a slender crownshaft; pinnæ broadly cuneate, the apex erose-dentate, the margins and midrib often prolonged, the terminal pair distinct or united in a briefly bifid flabellum, primary nerves 1 except in the 2–3-nerved apical pinnæ, secondary nerves 2–3, tertiary nerves fine and numerous, marginal nerves prominent: spadix infrafoliar; spathes 2, the outer persistent at anthesis, tardily deciduous, ancipitous, about equalling the peduncle, the inner persistent, equalling the spadix at anthesis, an incomplete third spathe sometimes present; peduncle elongate, often exceeding the rachis; rachillæ stoutish, simple, furcate or branched: flowers in groups of 2 staminate and a pistillate or reduced apically to pairs of staminate and pistillate or solitary staminate in spirals along the rachillæ; staminate flowers symmetric, the sepals imbricate, petals valvate, about three times as long as the sepals, stamens numerous with subulate filaments and linear medifixed introrse anthers, the anthers sagittate at the base, bifid at apex and erect in bud; pistillode ovoid with central cavity, narrowed into a slender neck and capitate tip and equalling or exceeding the stamens or briefly trifid at apex and shorter than the stamens; pistillate flowers regular, sepals and petals imbricate, staminodia 2 or more, dentiform to cupular, ovary shortly stipitate, ovoid with 3 recurved stigmas, unilocular, ovule apical or subapical and pendulous: fruit mostly less than 25 mm. long, ovoid or ellipsoid with terminal stigmatic remains, exocarp thin, smooth, mesocarp pulpy with stinging crystals and numerous coarse longitudinal fibers, endocarp thin, closely adherent to seed; seed ovoid with raphe branched from base toward apex, endosperm homogeneous or ruminate, embryo basal.

The genus Drymophlœus was erected by Zippel in a letter to Blume published in Algemeene Konst-en Letterbode and the brief description

reproduced in Flora of the same year. In Rumphia ii, 117–123, 1843 [2] Blume described in detail four species under the name Ptychosperma, all of which are now referred to Drymophlœus. The latter was very briefly characterized by Martius (Hist. Nat. Palm. iii, 186, 1838, and 314, 1849) who considered it with Seaforthia (Ptychosperma) but attributed it to Zippel and did not number it as a section. The few species were given alternative names as Seaforthia or Drymophlœus, indicating doubt as to the proper status of Drymophlœus.

Odoardo Beccari appears to have been the first writer to deal with the genus at length although Miquel (De Palm. Arch. Ind. 4, 1868) had accepted it definitely and described a new species, *D. ceramensis*. In Malesia, i, 41–47, 1877, Beccari included species now referred to Ptychosperma (Actinophlœus) with species of true Drymophlœus though attributing the genus to Blume who had, in fact, merely used Zippel's name in synonymy of Ptchosperma. Later (in Ann. Bot. Jard. Buitenzorg, ii, 100–127, 1885) he attributed the name to Zippel, circumscribed the genus in the most recently accepted sense and limited it to five species. The further complexities of the various treatments of Drymophlœus neither can nor need be discussed in detail here and for that reason only the basic references and history are given in this and following discussions.

Of late, material has become available that suggests the need for an examination of the relationship between Drymophlœus and Coleospadix, another genus very briefly described by Beccari in 1885 (op. cit. page 90), based on two species previously described as Ptychosperma. Coleospadix was not amplified until 1928 when Burret described two additional species from Halmahera in the Molucca Islands and noted the resemblance to Drymophlœus (Fedde, Repert. xxiv, 285). The resemblances and differences between the Moluccan species and Drymophlœus are summarized as follows:

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[2] The date for names appearing in the second volume of Rumphia is often given as 1836. That is the date found on the title-page and preface. The preface, however, was actually published early in 1837 as noted in a French translation of an article written by Blume in 1838 (Ann. Sci. Nat. ii, ser. 10, 369, 1838). A footnote to plates cited in this same article (op. cit. 372) states "Ces citations de planches se rapportent toutes au tome II du Rumphia, encore inédit." No exact dates have been ascertained for pages 9–93 following the preface but on pages 37 and 64 Blume cited parts of Endlicher's Genera Plantarum and Martius' Historia Naturalis Palmarum that appeared in 1837 (cf. Cat. Libr. Brit. Mus. Nat. Hist. ii, 529, 1904, and Journ. Bot. xlvi, 197, 1908). Pages from 93–173, including those cited above, and plates 138–168 were reviewed at length in Botanische Zeitung, i, 660–663 (September 1843) where the date of publication was given as 1843. Plates 83 and 84 accompanying the article cited in text were listed by Kunth (Enum. Pl. iii, 192, 1841) with the observation that descriptions were lacking. Either they appeared in or before 1841 or they were seen by Kunth before they were generally distributed. Danser (Blumea, iii, 203–211, 1939) has reviewed publication dates of Blume's Flora Javae and a similar study of Rumphia is much to be desired.

Drymophlœus	Coleospadix (Moluccan species)
Stems solitary	Stems solitary
Leaves regularly pinnate	Leaves regularly pinnate
Pinnæ cuneate, erose-dentate at apex, the *terminal pair united nearly to apex in a flabellum*	Pinnæ cuneate, erose-dentate at apex, the *terminal pair not united at apex*
Leaves vestite with medifixed elongate deciduous castaneous scales and peltate laciniate or fimbriate scales that are persistent or more or less deciduous	Leaves vestite with medifixed elongate deciduous castaneous scales and peltate laciniate or fimbriate scales that are persistent or more or less deciduous
Spadix infrafoliar below a slender condensed crownshaft, *simply branched or lower rachillæ furcate*	Spadix infrafoliar below a slender elongate crownshaft, *simply or twice-branched*
Peduncle elongate	Peduncle elongate
Outer spathe short, ancipitous, more or less persistent at least in anthesis, the inner equalling the spadix at anthesis and persistent in fruit, an incomplete third sometimes present	Outer spathe short, ancipitous, more or less persistent at least in anthesis, the inner equalling the spadix at anthesis and persistent in fruit, an incomplete third sometimes present
Flowers in groups of 2 staminate and a pistillate below, paired staminate and pistillate or solitary staminate above	Flowers in glomerules of 2 staminate and a pistillate below, paired staminate and pistillate or solitary staminate above
Staminate flowers symmetric, sepals subreniform, imbricate, petals valvate, ovate-lanceolate, about three times as long as sepals, *stamens 50-60, pistillode exceeding the stamens, ovoid, narrowed into a slender neck with capitate tip*	Staminate flowers symmetric, sepals subreniform, imbricate, petals valvate, ovate-lanceolate, about three times as long as sepals, *stamens about 25, pistillode shorter than the stamens, ovoid and briefly trifid at apex*
Pistillate flowers symmetric, sepals and petals imbricate, staminodes few, dentiform to cupular, ovary ovoid, unilocular with 3 recurved sessile stigmas, ovules apical or subapical and pendulous	Pistillate flowers symmetric, sepals and petals imbricate, staminodes few, dentiform to cupular, ovary ovoid, unilocular with 3 recurved sessile stigmas, ovule apical or subapical and pendulous
Fruit ovate-oblong, 15 mm. long with apical stigmatic scar, exocarp thin, mesocarp pulpy with numerous flat longitudinal fibers, endocarp thin, more or less adherent to seed	Fruit ovate-oblong, 15–22 mm. long with apical stigmatic scar, exocarp thin, mesocarp pulpy with numerous flat longitudinal fibers, endocarp thin, more or less adherent to seed
Seed ovoid with raphe much branched from base, *endosperm homogeneous*, embryo basal	Seed ovoid with raphe much branched from base, *endosperm ruminate*, embryo basal
Juvenile leaves entire or briefly bifid at apex	Juvenile leaves bifid to rachis at apex

Although floral details have been taken from limited material, the resemblances between the two genera prove striking, the more so in that they are apparently the only genera of their particular relationship that have persistent spathes on elongate peduncles and broadly cuneate pinnæ. The differences lie primarily in characters that appear to be of less than generic importance. Branching of the spadix is widely varied in many genera of palms, the number of stamens varies within the genera closely allied to Drymophlœus as do characters of the pistillode. Ruminate endosperm is an advanced condition appearing with homogeneous endosperm in a number of arecan genera, e.g. Euterpe, Hydriastele, Nengella, Ptychosperma, Reinhardtia, Synechanthus.

Specimens of the original species of Coleospadix, *C. litigiosus*, (Becc.) Becc. and *C. oninensis*, (Becc.) Becc., both from New Guinea, have not been available for study. Comparison of descriptions leaves little doubt that they are congeneric with the Moluccan species, *C. Beguinii*, Burret, and *C. porrectus*, Burret, which are represented by adequate material and do not seem generically distinct from Drymophlœus. Because one of the last two is in cultivation, they are transferred to Drymophlœus here in order that the most appropriate name may be used. A formal transfer of the genus itself and its original species is postponed because no study has been made of the types and furthermore because an examination of the relationship between *C. litigiosus* and the earlier *Drymophlœus angustifolius*, Blume, is required to ascertain whether they are distinct or the same, the latter a possibility noted by Beccari.

In connection with the Moluccan species of Coleospadix it should be pointed out that the name *Coleospadix gracilis* should be taken into account. The basis for this name is a description of Rumphius that is too vague for specific application and the history of the name is briefly reviewed with the recommendation that it be considered a *nomen confusum*.

Rumphius wrote of a palm in connection with his Saguaster minor and said that it grew in the Moluccas, Gelolo (Halmahera) and on a neighboring island belonging to New Guinea and called Sargile. Beccari thought Sargile a vernacular name but from the context in the original account it is clear that it is indeed the name of an island but one that does not appear on any maps thus far located. The palm described without illustration by Rumphius had a straight and firm trunk scarcely two fingers thick and 4–6 ulnas (8–12 feet) high and the hard black wood was used for spears by the indigens.

Beccari (Ann. Jard. Bot. Buitenzorg, ii, 101, 1885) excluded this palm from Drymophlœus as he interpreted it, noting that the genus had soft wood while wood of Actinophlœus (Ptychosperma) and Coleospadix was used for lances in New Guinea because of its hardness. Burret (Fedde, Repert. xxiv, 285, 1928) concluded that Rumphius actually referred to a species of Coleospadix since Beguin had noted that the wood of *C. Beguinii* was hard and dark. He was, however, unable to fix the name, stating merely that it was necessary to wait until the flora of the Moluccas was better known.

If only Halmahera were to be considered the name might at least be narrowed to the genus Drymophlœus in its broad application or to Coleospadix in a restricted sense. Since the palm is also supposed to occur in New Guinea the name may perhaps apply to species of Ptychosperma (Actinophlœus) as well. Because of the incomplete description and the possibility of its application to one of two or more genera, the name cannot be limited to any species except by arbitrary and undesirable means. The

following binomials have been based on Saguaster species e Gelolo, etc. of Rumphius and should be considered *nomina confusa*.

Areca olivæformis, Giseke var. *gracilis*, Giseke, Prael. Ord. Nat. Pl. 80 (1792).

Seaforthia jaculatoria, Mart. Hist. Nat. Palm. iii, 314 (1849).

Drymophlœus jaculatoria, Mart. Hist. Nat. Palm. iii, 314 (1849).

Coleospadix gracilis, (Giseke) Burret, in Fedde, Repert. xxiv, 285 (1928).

Of the several species of Drymophlœus only the two cultivated in this hemisphere will be considered in detail here. They may be distinguished as follows:

1. Terminal pinnæ united to or nearly to the apex in a flabellum: spadix with stout rachillæ, simply branched or the lower rachillæ furcate; staminate flowers with a pistillode exceeding the stamens: seed with homogeneous endosperm: wood soft and light: seedling leaves entire.....1. *D. olivæformis*

1. Terminal pinnæ not united, the apex bifid to the often awned rachis: spadix generally twice-branched with slender rachillæ; staminate flowers with pistillode shorter than the stamens: seed with ruminate endosperm: wood hard and dark: seedling leaves bifid.....2. *D. Beguinii*

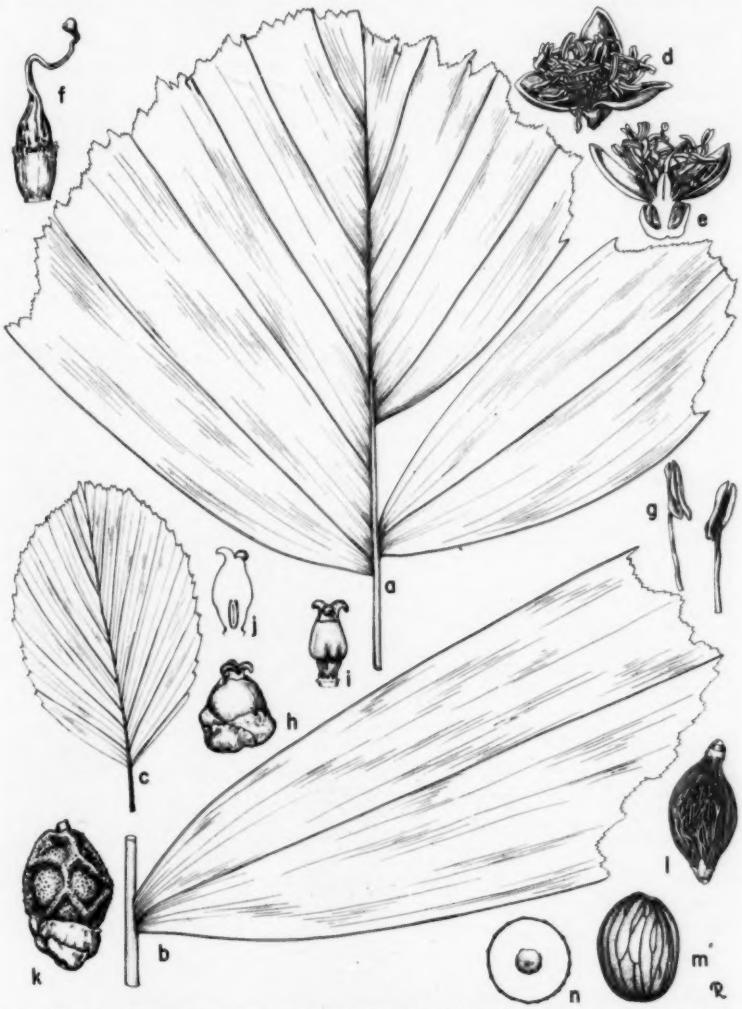
1. **Drymophlœus olivæformis,** (Giseke) Mart. Hist. Nat. Palm. iii, 314 (1849). Figs. 111–113.

Areca olivæformis, Giseke, Prael. Ord. Nat. Pl. 79 (1792).

(Saguaster minor, Rumphius, Herb. Amboin. i, 67, t. 15, 1750).

Stems to 6 m. high or more, 7 cm. diam., internodes to 15 cm. long: leaves regularly pinnate except at flabellate apex; sheath tubular, to 47.5 cm. long, striate when dry, densely pale-lepidote-tomentose; petiole to 1 m. long or more, rounded below, channeled above, densely dark-punctate and probably lepidote when young; rachis 1.7 m. long, densely dark-punctate; pinnæ alternate, 10–11 on each side at intervals of 6.5–17.5 cm., the basal pinnæ small, 15–22.5 cm. long, 2.4–6 cm. wide, the lower 35 cm. long on midrib, 40 cm. on upper, 19 cm. on lower margins 15 cm. wide, the median 45 cm. on midrib, 42.5 cm. on upper, 30 cm. on lower margins, 19 cm. wide, the apical 32.5 cm. along rachis, 27.5 cm. on lower margin, all with 1 primary, prominent marginal, 2–3 secondary and numerous tertiary nerves except the several-nerved terminal pair that are united to within 1.5 cm. of apex, apices erose-dentate and præmorse, margins curved toward the narrow base, the abaxial shortest, the adaxial about equal to or shorter than the midrib; seedling leaf about 8-nerved, ovate in outline, to 7.5 cm. long, 7.5 cm. wide, the apex very shortly bifid: spadix simply branched or with the lower rachillæ furcate; outer spathe ancipitous, acute, ca. 20 cm. long, 3 cm. wide, densely pale lepidote-tomentose and with scattered, shining, castaneous, medifixed twisted scales to 0.5 mm. long, the inner inserted ca. 5.5 cm. above outer; peduncle elongate, 20 cm. long or more, deciduous lepidote-tomentose; rachis 8 cm. long, deciduous lepidote-tomentose; rachillæ 6–10, stoutish, deciduous pale-lepidote-tomentose, all simple or the lower sometimes furcate, to 20 cm. long or more: staminate flowers symmetric, sepals 2.5–3 mm. high, subreniform and basally subcucullate, prominently nerved when dry, petals valvate, reflexed at anthesis, ovate-lanceolate, 8 mm. long, 4 mm. wide, united

with base of the pistillode for about 2.5 mm., stamens 50–60, filaments 5 mm. long, anthers 2 mm. long, pistillode exceeding the stamens, ovoid, narrowed to slender neck, the apex capitate; pistillate flowers symmetric,



111. DRYMOPHLŒUS OLIVÆFORMIS (*Fairchild Tropical Garden Expedition 331, Langlois*). a, apical pinnæ ×¼; b, median pinnæ ×¼; c, seedling leaf ×⅓; d, staminate flower ×2; e, staminate flower longitudinal section ×2; f, pistillode ×3; g, anthers ×5; h, pistillate flower ×2; i, pistil ×2; j, pistil longitudinal section ×2; k, fruit ×1⅓; l, fruit with exocarp removed ×1⅓; m, seed ×2; n, seed cross-section ×2.

sepals subreniform, 2.5 mm. high, petals 5 mm. high, strongly nerved, staminodes 2–3 or more, ovary 5 mm. high: fruit lacquer-red on greenish rachillæ with yellow cupule at maturity, glabrous, 15–18 mm. long, 12–13 mm. wide (when dry), ovoid; seed ovoid, 8 mm. long, 6 mm. in diameter, endosperm homogeneous with central cavity.

Amboina Island, Dutch East Indies: Lateri and Gelala, August and September, 1913, *C. B. Robinson Pl. Rumph. Amb. 21* (US), *22* (A); Amboina, May 10, 1940, *Hugo Curran, Fairchild Tropical Garden Expedition 331* (seed and photograph only) (BH), specimen from tree cultivated at The Retreat, Nassau, New Providence, Bahama Islands, July 1949, *A. C. & M. Langlois* (BH).

Rumphius stated that his Saguaster minor grew on the islands of Bali and Ternate but he knew it also as a rarer plant of Amboina where he lived and worked. The most recent collection from Amboina (Fig. 112), from which seed was distributed as *Fairchild Tropical Garden Expedition 331*,

112. DRYMOPHLŒUS OLIVÆFORMIS (*Fairchild Tropical Garden Expedition 331, Curran*). Leaf-sheath, unopened and fruiting spadices, portion of leaf. Photograph by Edward Beckwith.

113. SAGUASTER MINOR. Reproduced from Rumphius, Herbarium Amboinense, i, t. 15.

agrees well with the original plate of Saguaster minor, reproduced here for comparison (Fig. 113). Although *Drymophlœus olivæformis* has been variously interpreted, it is with little hesitation that the name is used for plants from Amboina now cultivated in this hemisphere. The same conclusion was reached by Merrill (An Interpretation of Rumphius's Herbarium Amboinense, 120, 1917) for the earlier collections of Robinson cited above.

As a cultivated plant, *Drymophlœus olivæformis* is an attractive subject for frost-free areas. It is a shade-loving palm and under proper conditions develops a handsome crown of glossy dark-green leaves with leathery "fish-tail" pinnæ. The slender straight brown stem and lighter green crownshaft contrast with the greenish-yellow spadix bearing bright lacquer-red fruit at maturity. Trees from which seed was originally obtained were said to be 20 feet high. In the garden of Mr. and Mrs. Langlois, a specimen fruited when only 8 feet high but has now reached considerably larger proportions.

A completely different palm, grown in this hemisphere under the name *Balaka Seemanii*, has also been determined as *Drymophlœus olivæformis*. Examination of the fruit shows this palm to be a species of Ptychosperma as yet undetermined but readily distinguished from both Drymophlœus and Balaka by the sulcate seed, lack of persistent spathes and much narrower pinnæ.

† 2. **Drymophlœus Beguinii,** (Burret) trans. nov. Figs. 114, 115.
Coleospadix Beguinii, Burret, in Fedde, Repert. xxiv, 286 (1928).

Straight hard-stemmed palm 3–5 m. high, ca. 5 cm. in diameter with about 6 leaves and sometimes epigeous roots: leaves more or less erect; sheath ca. 50 cm. long, densely white-floccose with basifixed laciniate twisted castaneous scales outside, smooth, shining and orange within when dry; petiole 25 cm. long, densely and minutely dark-punctate, nearly terete with shallow groove above; rachis ca. 1.4 m. long, convex below, bifacial above with deciduous scales, becoming densely and minutely dark-punctate; pinnæ dark green, shining, glabrous except the minutely dark-punctate prominent mid- and marginal nerves, 11–13 on each side of the rachis, alternate, borne at nearly 90° angle with the rachis, broadly cuneate in outline, erose-dentate at apex with the upper margin produced, 2–2.5 cm. long at insertion on the rachis, the lowermost 14–30 cm. long, 5–7.5 cm. wide at the apex, the median 32–40 cm. long, 16–25 cm. wide, the apical 16–19 cm. long, 14–19 cm. wide and separated to the awned tip of the rachis: spadix pendulous, once to twice-branched, about 60 cm. long; spathes 3, the outer deciduous, ancipitous, 25 cm. long, 2.5 cm. wide, splitting on one side, densely deciduous white-tomentose, with scales similar to those of the sheath, the second persistent, nearly equalling the rachis, similar to the outer but not ancipitous and with more numerous scales becoming more or less glabrate and dark-punctate in age, the inner incomplete, truncate, not exceeding the peduncle; peduncle 15–27 cm.

long, rachis glabrous, ca. 45 cm. long, rachillæ 13–16, to 30 cm. long, glabrous, the lower stout and branched with as many as 7 secondary branchlets, the upper simple: staminate flowers reddish, sepals 1.5 mm.

114. DRYMOPHLŒUS BEGUINII (*Fairchild Tropical Garden Expedition 402, Langlois*). a, apical pinnæ ×⅓; b, median pinnæ ×⅓; c, seedling leaf ×⅓; d, staminate flower ×2; e, staminate flower longitudinal section ×3; f, pistillode ×8; g, pistillate flower ×2; h, pistillate flower longitudinal section ×3; i, fruit ×2; j, seed cross-section ×2.

high, broadly rounded and imbricate, petals 5 mm. high, valvate, cymbiform, stamens about 24, equalling or slightly exceeding the petals with subulate filaments and sagittate bifid-tipped linear anthers, pistillode ovoid, 2 mm. high, briefly trifid at the apex with a central cavity; pistillate flowers subglobose, sepals imbricate, 2 mm. high, the margins minutely denticulate, petals imbricate with shortly valvate deltoid apex, 5 mm. high, staminodes about 3, scale-like, ovary 5 mm. high, ovoid, stigmas 3, recurved, the fruiting perianth spreading, reddish-brown with sepals 3 mm. long, petals 7 mm. long: fruit red at maturity, ovoid, stipitate and rostrate within the cupule with apical stigmatic scar, 14–15 mm. long, 8–9 mm. wide, exocarp thin, mesocarp fleshy with numerous soft longitudinal fibers, endocarp membranous, adherent to the seed; seed 8–9 mm. long, 6–8 mm. wide, with deeply ruminate endosperm and basal embryo, raphe branched from the base: seedling leaf bifid, the lobes simple and toothed along the margin.

Molucca Islands, Dutch East Indies: Halmahera Island; Weda, February 1, 1923, *Beguin 2347* (BO, lectotype)[8]; Dagasoeli Island, North

115. DRYMOPHLŒUS BEGUINII (*Fairchild Tropical Garden Expedition 402, Curran*). Portions of leaf, flowering and unopened spadices, leaf-sheath, fruiting spadix.

Loloda Group, June 7, 1940, *Hugo Curran, Fairchild Tropical Garden Expedition 402* (seed and photograph only), specimens from trees cultivated at The Kampong, Coconut Grove, Florida, 1949, *David Fairchild* (BH) and in Nassau, New Providence, Bahama Islands at Prospect Hill by Mrs. Anne Archbold, 1950, *A. C. Langlois* (BH) and The Retreat by Mr. & Mrs. A. C. Langlois, February 1952, *Moore 6034* (BH).

The trees from which seed was introduced as *Fairchild Tropical Garden Expedition 402* were found on Dagasoeli Island, one of the small islands west of Halmahera. Foliage and spadices were photographed at the time of collection (Fig. 115) but the specimens are no longer extant. Trees have flowered and fruited in the Bahama Islands and in Florida. Comparison of specimens and observations from living trees leads me to identify the cultivated plants as *Drymophlœus Beguinii*.

The two species of Drymophlœus in the Moluccas were distinguished by Burret primarily on characters of the pinnæ. In *D. Beguinii*, known by the local name "Pesem", the pinnæ are relatively short and broad with curved margins, the apical pair tends to be broader and stands at nearly right angles to the rachis; in *D. porrectus*, the pinnæ are long and narrow with nearly straight margins and the apical pair is borne at an angle of about forty-five degrees with the rachis. The rachillæ of *D. Beguinii* are shorter and stouter than those of *D. porrectus*. Fruit of the former was described as red at maturity while that of the latter was said to be greenish-gold.

Although the pinnæ of cultivated specimens tend to be somewhat longer and broader than the pinnæ of isotype specimens of *D. Beguinii*, they agree remarkably well in general proportion. In no case have pinnæ as long and narrow as those of *D. porrectus* been seen. Rachillæ and fruit of cultivated material also agrees with the isotype specimens of *D. Beguinii*.

Trees of *Drymophlœus Beguinii* in cultivation are similar to *D. oliviæformis* in aspect but have less leathery pinnæ, darker and harder stems with the leaf-sheaths forming an elongate and poorly marked crownshaft above the spadices. The spadices vary somewhat and in cultivation are often less strongly branched than those photographed from the wild. The slender rachillæ and seed with ruminate endosperm, however, contrast with the stouter rachillæ and seed with homogeneous endosperm of *D. oliviæformis*.

† **Drymophlœus porrectus,** (Burret) trans. nov. Fig. 116.

Coleospadix porrectus, Burret, in Fedde, Repert. xxiv, 287 (1928).

[2] As previously noted, the holotypes of both *Drymophlœus Beguinii* and *D. porrectus* were destroyed in the loss of the Berlin herbarium during the war. Since isotypes of both species are in the Herbarium Bogoriense it seems proper to designate them as lectotypes. Similarly the isotypes of *Siphokentia Beguinii* (*Beguin 1995*), type of the genus and *S. pachypus* (*Beguin 2349*) discussed on page 310, are designated as lectotypes. Photographs of the lectotypes are on deposit at the Bailey Hortorium.

Molucca Islands, Dutch East Indies: Halmahera Island; Galela, Soa Tobaroe, December 23, 1921, *Beguin 1930* (BO, lectotype).

116. DRYMOPHLŒUS PORRECTUS (*Beguin 1930*). a, apical pinna ×¼; b, median pinna ×¼; c, branch of spadix ×¼; d, fruit ×1½.

Without more intimate knowledge of the Moluccas and their flora it is difficult to evaluate the specific differences given by Burret. As represented by known specimens and field notes the two species are distinguished by several characters and it seems desirable to transfer both to Drymophlœus.

SIPHOKENTIA

In June of 1940 seed of an attractive palm was collected by members of the Fairchild Garden Expedition at Kahatola Island, one of the South Loloda Islands west of Halmahera in the Moluccas. Samples were distributed for trial in Florida and the Bahama Islands and in 1950 specimens from bearing trees were received at the Hortorium from Dr. Fairchild in Coconut Grove, Florida, and from Mr. and Mrs. A. C. Langlois in Nassau, New Providence, Bahama Islands.

It was suggested by Mr. and Mrs. Langlois that the palm might be one of the two species of Burret's genus Siphokentia described in 1928 from specimens collected by Beguin in 1922 and 1923 on Halmahera Island. This conclusion as to genus was verified from examination of herbarium material and in the spring of 1951 from living trees but specific determination was withheld while an attempt was made to locate authentic specimens. Comparison of material from trees cultivated in the New World with the isotype specimens establishes the identity of the cultivated species as *Siphokentia Beguinii*, Burret, type of the genus. With ample material at hand a complete description can be provided and the relationship of the genus more clearly stated.

SIPHOKENTIA, Burret, in Notizbl. Bot. Gart. Berlin, x, 198 (1928).

Solitary monœcious trees to 10 m. high: leaves 5–7 or more in a terminal coma, sheaths tubular forming a crownshaft, petiole short, blade pinnate, the terminal and usually the basal pinnæ several-nerved, the intermediate mostly with 1 primary, 2–3 secondary, numerous tertiary and prominent marginal nerves, the apices erose-dentate and præmorse: spadix infrafoliar, scopiform, simply branched; spathes 2, the outer chartaceous, ancipitous, the inner similar but not ancipitous; peduncle short, more or less recurved, the rachis short, recurved, glabrous, bearing several arcuate-pendulous slender glabrous rachillæ: flowers sessile in groups of 2 staminate and 1 pistillate in scrobiculi along the entire rachilla, the groups spiralled at base becoming decussate above; staminate flowers asymmetric, calyx very small, gamosepalous with 3 acute lobes, petals valvate, asymmetric, lanceolate-acuminate, much exceeding the calyx, stamens 9–10, nearly sessile, the anthers linear, erect in bud, pistillode minute; pistillate flowers nearly symmetric, calyx gamosepalous, cupular, more or less truncate with 3 short lobes, petals 3, deltoid-acuminate, distinct at anthesis, imbricate at the base, valvate above becoming connate at the base in a tube equalling the calyx in fruit, staminodes 6–few or lacking, squamiform, ovary depressed-globose with 3 recurved sessile stigmas, unilocular,

ovule parietal near the base: fruit narrowly cylindric from a shortly stipitate base, capped by a conic protuberance with more or less persistent stigmas; exocarp thin, mesocarp with longitudinal fibers in mealy yellow pulp, endocarp membranous, closely adherent to seed; seed oblong-ovoid, the raphe about as long as seed with many anatamosing lateral branches; albumen deeply but laxly ruminate; embryo basal.

As Burret has indicated, the relationship of Siphokentia is with Gronophyllum, Scheff. of Ceram from which it differs in the tubular calyx of the pistillate flowers. Kentia, Blume and Gulubiopsis, Becc. are also closely related but differ in having acuminate or simply bifid pinnæ and plane endosperm as well as distinct pistillate sepals.

The genus is known only from Halmahera and adjacent islands of the Moluccas. Burret described two species, *S. Beguinii* and *S. pachypus*, which are distinguished as follows:

1. Fruit borne on a more or less elevated cushion separated from the thin subtending bract by a distinct space: rachis of the leaf glabrous or nearly so at maturity: trunk not expanded and often more slender at the base than above.....*S. Beguinii*

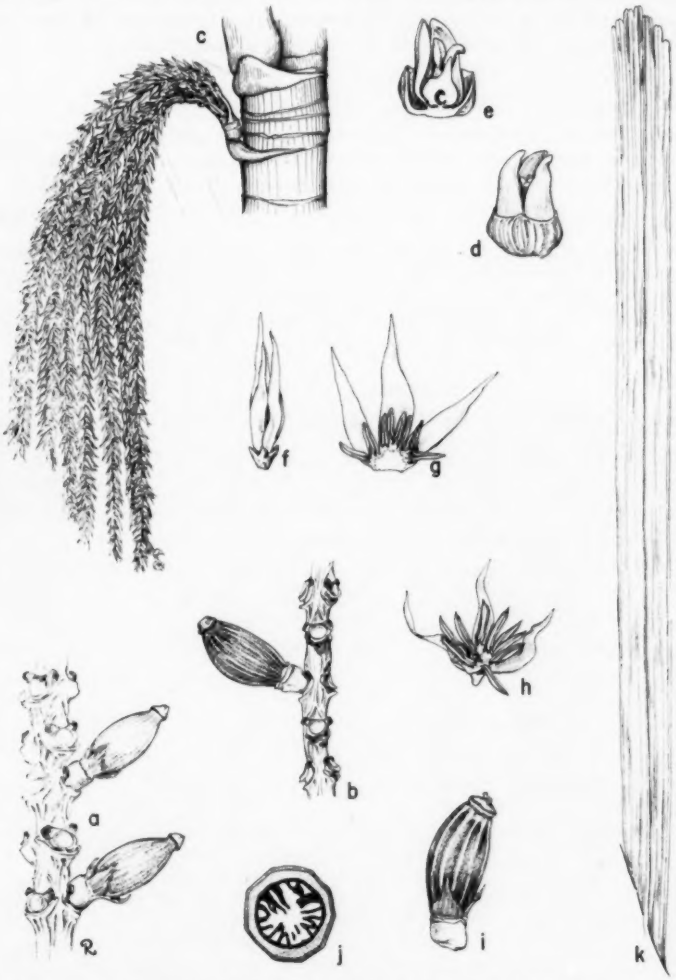
1. Fruit borne on a somewhat depressed cushion closely subtended by a thickened horny-margined bract: rachis of the leaf more or less persistently tawny-lepidote-tomentose: trunk thickened at the base.....*S. pachypus*

Plants cultivated in this hemisphere agree well with the description and specimens of *S. Beguinii*. Whether the distinctions between the two known species are adequate to maintain them is questionable. One small tree at the United States Plant Introduction Garden, Coconut Grove, Florida, has developed a thickened base and characters of the spadix and vesture of the leaves appear to vary. Further study of cultivated and wild material is desirable to determine whether *S. pachypus* can be kept apart. The following description of *S. Beguinii* is drawn from both specimens and living plants.

Siphokentia Beguinii, Burret, in Notizbl. Bot. Gart. Berlin, x, 198 (1928). Figs. 117–120.

Stems solitary, to 6 m. high or more, 10 cm. in diameter, not thickened at the base: leaves 5–10, the sheath 65–75 cm. long, pruinose and more or less densely and minutely brown-scaly, strongly ribbed outside in drying, the margins strongly curved outward and coiled exposing the glabrous, reddish, striate inner surface, the apex with a thin irregular ligule-like tip; petiole 6.5–13 cm. long, 18–30 mm. in diameter at the base, channeled above, rounded below, smooth and densely and minutely dark scaly below; rachis ca. 9.5 dm. long, channeled to keeled above and minutely lepidote, rounded and more or less densely lepidote below; blades 30–31-nerved, pinnæ regularly disposed, the basal pair 3–5-nerved, 5.25–7.5 cm. wide at middle, 58–62 cm. long on upper margin, somewhat falcate, the apex obliquely and falcately erose-dentate, intermediate pinnæ 17–18 on either side, strongly reduplicate at insertion, more or less evenly spaced about 2–4 cm. apart, the central to 60 cm. long, 4 cm. wide, with 1 primary

nerve, 2 prominent secondary nerves toward the margins and 3–5 tertiary nerves between or rarely broader with several primary nerves, the margins pale, broadly thickened, nerves with linear-lanceolate medifixed shining



117. SIPHOKENTIA BEGUINII (*Fairchild Tropical Garden Expedition 386, Langlois* except b). b, portion of spadix from isotype ×1½; c, spadix in staminate flower ×⅙; d, pistillate flower ×1⅓; e, pistillate flower longitudinal section ×1⅓; f, staminate flower ×2; g, staminate flower expanded ×2; h, staminate flower open ×1⅓; i, fruit ×1⅔; j, fruit cross-section ×3; k, median pinna ×⅓; SIPHOKENTIA PACHYPUS. a, portion of spadix from isotype ×1½.

brown scales, the surface glabrous above, paler below, densely and minutely brown-punctulate on surface and nerves, apex erose-dentate, apical segments confluent, 8–10-nerved, ca. 25 cm. long on upper margin, 14–19 cm. wide at the erose-dentate tip: spadix nearly sessile, spathes 2, the outer 58 cm. long, ca. 8 cm. wide, papery with more or less prominent nerves and coriaceous cristate margin, the inner slightly smaller, papery, not cristate; peduncle 3–4.5 cm. long, with 2 scars and semilunar base, rachillæ 9–15, to 44 cm. long, 3 mm. wide at internodes, pendulous or arching at anthesis: flowers ca. 1 cm. apart in any given line; staminate flowers asymmetric, calyx 1.5 mm. high, more or less tubular and 3-lobed, the lobes narrow and acute, petals 12–14 mm. long, lanceolate-acuminate, unequal and asymmetric, stamens 9–10, nearly sessile, the anthers linear, 5 mm. long, apiculate, pistillode minute; pistillate flowers nearly symmetric, calyx 2–2.5 mm. high, cupular, more or less truncate with 3 short acute lobes, petals free, imbricate at base, valvate above or sometimes very shortly connate with imbricate auricles, 5 mm. long, the apex deltoid-attenuate, ovary 2.5 mm. high, depressed-globose, stigmas 3, connate in bud, recurved at anthesis, 1.5 mm. long, staminodes few or lacking, squamiform: fruit 15 mm. long, 5.5 mm. diam., shortly stipitate within the calyx, slightly curved, smooth, shining, costate, reddish at maturity, with low

118. Siphokentia Beguinii (*Fairchild Tropical Garden Expedition 376, Curran*). Outer and inner spathes, staminate, pistillate and young fruiting spadices, leaf-sheath, leaf portions. Photograph by Edward Beckwith.

conic crown and persistent stigmas, calyx cupular in fruit, 3 mm. high, corolla-valves triangular and acute in fruit, 4 mm. long, appressed to the fruit, the bases connate in a tube about the base of the fruit and equalling the calyx; mesocarp fibrous, of two layers, the outer fibers cartilaginous, thick, spaced giving costate appearance to fruit, the inner slender, more or less interwoven; seed attached basally, ellipsoid, 9 mm. long, 4.5 mm. wide.

Molucca Islands, Dutch East Indies: Halmahera Island; Soa Tobaroe, June 2, 1922, *Beguin 1995* (BO, lectotype); Kahatola Island, South Loloda Group, June 1940, *Hugo Curran, Fairchild Tropical Garden Expedition 386* (seed only), specimens from trees cultivated at The Kampong, Coconut Grove, Florida, 1950, *David Fairchild* (BH); The Retreat, Nas-

119. SIPHOKENTIA BEGUINII (*Fairchild Tropical Garden Expedition 386, Fairchild*). Tree grown in open at The Kampong, Coconut Grove, Florida. Photograph courtesy David Fairchild.

sau, New Providence, Bahama Islands, 1949, *A. C. & M. Langlois* (BH).

120. SIPHOKENTIA BEGUINII (*Fairchild Tropical Garden Expedition 386, Fairchild*). Spadix in staminate flower at The Kampong. Photograph courtesy David Fairchild.

In addition to the cited specimens, material collected as *Fairchild Tropical Garden Expedition number 376* by Hugo Curran at Bai River, Bajahi Bay, Halmahera Island, May 30, 1940, was photographed by Edward Beckwith. The actual specimens are no longer extant but apparently belong to the same species as that cited above as number 386. The photograph is reproduced as Fig. 118 to supplement details in Fig. 117.

Siphokentia Beguinii, known in the Moluccas as "Gori Poetoe", has thus far proved hardy in the Miami region of Florida. Trees in flower have been seen at the Fairchild Tropical Garden, at The Kampong (home of Dr. and Mrs. Fairchild) and at the United States Plant Introduction Garden, all in Coconut Grove or Coral Gables. A photograph taken in July 1949 (Fig. 119) shows a tree set out at The Kampong in June 1944. This tree is growing in full sun and has developed slowly with very short internodes. A second tree, grown in the shade at the Kampong, is taller with elongate internodes. In the garden of Mr. and Mrs. A. C. Langlois in the Bahama Islands, a handsome specimen has reached a height of more than 20 feet with a trunk over 3 inches in diameter in the same length of time but under more favorable conditions.

The five to ten arching and spreading leaves, glossy green above and dull below, form a handsome crown in mature trees and the arched one-sided spadix with masses of creamy-white staminate flowers (Fig. 120)

followed at length by slender bright red fruits is both unusual and colorful. The leaves vary considerably in cutting. They may be regularly divided with evenly spaced one-nerved pinnæ or irregularly divided with broader, several-nerved pinnæ interspersed among the narrow ones. At the tip of the leaf, the pinnæ are generally united in a broad arching fan. When protected from the wind the segments have a toothed more or less truncate tip. Seedling leaves are said to be beautifully reticulated and juvenile leaves tend to be entire. It may, therefore, offer possibilities as a greenhouse palm in addition to its potentiality as an outdoor palm in the far south of this country or in the tropics of the western hemisphere.

ARTICLE 14.
TAXONOMIC STUDIES IN THE CACTACEÆ.
I—PROBLEMS IN CLASSIFICATION AND NOMENCLATURE.

By Reid Moran

The revision of the Cactaceæ for Hortus Third is largely a matter of compilation, with no time for extended research. Most of the problems that arise cannot be solved but can only be identified and circumvented.

It appears certain for many genera of this family that too many species will be admitted. A compilation cannot be uniformly conservative when there are few conservative sources from which to compile. With regard to specific limits, the conservative treatment of Benson (1950) has largely been followed for Arizona species, but for most areas there is no comparable treatment. Many supposed species are inadequately described, without comparison to related species, or are described from single cultivated specimens without reference to the variation in natural populations. Furthermore, it is often evident that the authors of these species have a very narrow species concept, under which every minor variant must have a name. In view of the great variability known for many species of cacti, it often appears probable that these proposed species are mere forms of polymorphic species. From the scant information available, however, it is usually impossible to make formal reductions to synonymy. An adequate revision of the species in most groups can be worked out only on the basis of field study.

Delimitation of genera in the Cactaceæ is difficult and subject to wide disagreement. To be sure, some taxa are so distinct that they are almost universally accepted as genera. However, it often appears—at least on the basis of gross characters—that even very diverse taxa are connected by series of intermediates so that it is difficult to draw natural boundaries. Buxbaum (1951) probably was right in holding that there has been much parallel evolution in the family and that similar plants which are sometimes considered congeneric may actually be corresponding stages on parallel but widely different lines of descent. Thus there is the old problem of what characters may be considered fundamental. Furthermore, many species are so imperfectly described that their condition with respect to certain critical characters cannot be ascertained. Hence their generic position is uncertain, and the value of these characters for generic distinction cannot be assessed.

Most authors now agree that the large collective genera, such as Cereus and Echinocactus of older treatments, are unnatural and untenable and

that many of the newer segregates must be recognized if a natural classification is to be achieved. It appears, however, that some authors have carried generic segregation farther than is necessary for or consistent with a practical classification. This of course is a matter of opinion.

Certain characters have rather arbitrarily been chosen as the key marks of genera. One example may be given. As various authors have pointed out, the reduction of flowers, with loss of bristles, wool, and finally scales from the ovary, undoubtedly has occurred in several parallel lines of descent. Related plants with and without scales or with and without axillary wool represent easily distinguished stages in such a reduction series and have therefore sometimes been placed in separate genera. The presence or absence of scales or axillary wool or bristles, if taken in conjunction with other characters, may help to distinguish genera; but the erection of a genus on the basis of one such difference seems arbitrary in the extreme.

Among recent students of the Cactaceæ there seems to be an overemphasis on geographic distribution. For some proposed genera the chief claim to distinction appears to be disjunct distribution. In some systems even the grouping of genera into higher taxa is based largely on the assumption of long-continued completely independent evolution in North and South America or on the east and west sides of the Andes. It is true that many taxa of cacti are endemic to one continent or the other, but it does not follow that they must therefore necessarily be treated as genera. Students of other families retain many genera, and indeed some species, with distributions disjunct in North and South America. In fact, one species of cactus, *Opuntia tunicata*, has such a distribution, being common to Mexico and the Andes. Generic distinction cannot be assumed without morphological basis.

Since the small segregates are likely to be more natural than the original larger genera, their recognition (but not necessarily their segregation as genera) is a useful intermediate step in building a more natural classification. When the various small taxa seem to form a more or less continuous series or reticulum, it is difficult to know where to draw generic boundaries. Though the extremes of the series are very different, it may be difficult to find a clear natural break. Therefore, it is often only on the basis of extensive and detailed morphological studies that the small segregates can be combined into natural larger genera, and of course it may sometimes be that the facts permit no satisfactory solution.

There is now little solid basis for new generic consolidations. Furthermore, it seems best to avoid long lists of new combinations for species concerning whose validity there is no reliable information. Therefore, although some of the larger genera are retained in Hortus Third despite proposed subdivision, few new consolidations are made. Consequently

some apparently weak segregate genera are maintained with only an indication of the disposition of them which from present evidence seems best.

CEPHALOCEREUS, Pfeiffer vs. CEPHALOPHORUS, Lem.

Werdermann (1937b) proposed that Cephalocereus, Pfeiffer, be conserved against Cephalophorus, Lem. According to Lanjouw (1952), this name is provisionally approved for conservation. Since, however, Cephalophorus clearly is a *nomen provisorium*, Cephalocereus does not need to be conserved against it.

CORYPHANTHA, Lem.

Berger (1929) combined Escobaria, Britt. & Rose, Neobesseya, Britt. & Rose, and Neolloydia, Britt. & Rose, with Coryphantha, Lem. Buxbaum (1951) placed Neolloydia in one "ramus", Escobaria and Neobesseya in a second, and Coryphantha in a third, saying that they were corresponding stages in parallel lines of evolution. In accordance with his views, Neolloydia is kept separate from Coryphantha. His phylogenetic scheme implies that the other two taxa cannot be combined with Coryphantha unless the very different Ferocactus is also included; but this interpretation seems open to question (Moran, 1953). At least until further evidence is presented, the three groups may be kept together.

Coryphantha, Lem. Cactées, 32 (1868).

† Sect. **Euescobaria,** (Buxb.) Moran, stat. nov.

Escobaria subgen. *Euescobaria*, Buxb. in Oesterr. Bot. Zeitschr. xcviii, 78 (1951).

† Sect. **Lepidocoryphantha,** (Backeberg) Moran, stat. nov.

Lepidocoryphantha, Backeberg, Blät. f. Kakteenf. 1938, pt. 6, [14, 18, 22] (1938), *pro gen.*

† Sect. **Pseudocoryphantha,** (Buxb.) Moran, stat. nov.

Escobaria subgen. *Pseudocoryphantha*, Buxb. l. c.

† **Coryphantha Roseana,** (Böd.) Moran, trans. nov.

Echinocactus Roseanus, Böd. in Zeitschr. f. Sukkulentenk. iii, 363 (1928).

† **Coryphantha strobiliformis,** (Poselger) Moran, trans. nov.

Mammillaria strobiliformis, Scheer, in Salm-Dyck, Cact. Hort. Dyck. 1849, 104 (1850), not Engelm. (1848), and not Muehlenpfordt (1848).

Echinocactus strobiliformis, Poselger, in Allg. Gartenz. xxi, 107 (1853).

ECHINOCACTUS, Link & Otto, and FEROCACTUS, Britt. & Rose

Schumann (1898) founded a subgenus Euechinocactus of Echinocactus; but since it included none of the original Echinocactus species of Link and Otto, it is in no sense typic and may be disregarded. Britton and Rose (1922), in dismembering the old collective genus Echinocactus, were the first to name a lectotype. Link and Otto (1827) saw flowers of only two of their species of Echinocactus; of these two they considered only *E. platyacanthus* a true species of Echinocactus, whereas the other they said was little different from Cereus. Britton and Rose, therefore, were justified in selecting *E. platyacanthus* as the type, and their typification of Echinocactus should be upheld.

Britton and Rose were unable to identify *E. platyacanthus* with any living plants. Croizat (1943) expressed doubts that its identification would ever be possible. As he pointed out, the crude original plate does not show the flattened spines alluded to in the epithet "platyacanthus", and it is not even certain that the young plant shown in the plate is conspecific with the larger plant whose flowers were described. As a matter of fact, although in the brief diagnosis of the species the central (larger) spines are described as flat, the following description says "Die grossern Stacheln rund. . ."

As *E. platyacanthus*, Rost (1931) described and illustrated a plant he had collected in San Luis Potosi, and Bravo (1937, fig. 236) illustrated a rather similar plant collected by McDowell in central Mexico. Bravo's description evidently was based on that of Link and Otto, but Rost's apparently was based on his own plant. The two photographs and Rost's description agree fairly well with the original plate and description of *E. platyacanthus*. The spines of the photograph are very similar to those of the plate, and Rost's description of the flower agrees with the original so far as they are comparable. Aside from the above-mentioned inconsistency in the original description of the spines, the chief discrepancy is that Link and Otto described the ribs as acute, whereas the photographs show the confluent areoles and longitudinally grooved ribs characteristic of mature plants of various large Mexican species of Echinocactus. Although these characters would not be expected to show in the young plant of the plate, they should perhaps have been evident in the large plant that Link and Otto also had. Despite this seeming discrepancy, however, I am willing to agree with Rost and Bravo in identifying this plant as *E. platyacanthus*.

Whether or not *E. platyacanthus* is specifically identifiable, however, there seems no reason to doubt that it belongs with the other large Mexican plants included by Britton and Rose in Echinocactus. The large size, the woolly crown, the size and color of the flowers, and especially the somewhat pungent ("etwas stachlicht") outer perianth-segments, taken

together, eliminate from consideration all other known Mexican cacti.

Croizat (1943) treated *E. platyacanthus* as a synonym of *Cactus latispinus*, Haw. He intended this treatment to "certify" *E. platyacanthus*, the lectotype of Echinocactus, which he considered otherwise unidentifiable; and he justified this treatment by the fact that DeCandolle (1828) listed both names as doubtful synonyms of *E. cornigerus*, DC. Since Britton and Rose made *E. platyacanthus* the lectotype of Echinocactus and placed *C. latispinus* in Ferocactus, Croizat concluded that Ferocactus should be considered a synonym of Echinocactus. However, since *C. latispinus* is not the type of Ferocactus, this does not necessarily follow. Furthermore, it appears from the original descriptions that *E. platyacanthus* and *C. latispinus* are very different and surely belong to different species. Each of these old names has been identified with a plant known today, and these identifications, if not exact, probably are approximately so. As may be seen in figures 226 and 236 of Bravo (1937), these two plants are very different. Whether they should be included in the same genus of course remains a matter of opinion. It is clear, however, that the reduction of Ferocactus is not automatic. Ferocactus will be retained in Hortus Third.

EPIPHYLLUM, Haw., PHYLLOCACTUS, Link, and ZYGOCACTUS, Schum.

Werdermann (1937a) proposed that Phyllocactus, Link, be conserved against Epiphyllum, Haw., and that Epiphyllum, Haw. emend Pfeiffer (excl. typ.), be conserved against Zygocactus, Schum. According to Lanjouw (1952) these names have been provisionally approved for conservation. However, according to a letter from Dr. F. A. Stafleu of the International Bureau of Plant Taxonomy and Nomenclature, a report to the special committee recommends that Werdermann's proposal be rejected. Presumably, therefore, the names will not be conserved. The correct names, reinstated by Britton and Rose (1913, 1923), will be retained in Hortus Third.

Phyllarthus, Neck., has been listed by Schumann (1897) and others as a synonym of Epiphyllum. Since it was published earlier, the question arises whether Phyllarthus should not be taken up in place of Epiphyllum. Although Index Kewensis and various authors have treated Phyllarthus as a generic synonym, Necker (1790) clearly designated taxa of this rank as species; as such, it would not conflict with Epiphyllum. Necker's original description includes certain dubious statements, saying, for example, that the outer perianth-segments are staminiferous and persistent, the inner ones deciduous. On this basis the name might be treated as a *nomen confusum*. However, Greene (1904) is perhaps right that it is the equivalent of Opuntia, Mill., plus the pre-Linnæan Phyllanthus (=Epiphyllum,

Haw.). Schumann thought the name "Phyllarthus" was probably an erroneous spelling of "Phyllanthus". If so, the type would doubtless be *Epiphyllum Phyllanthus;* but this is pure conjecture. Since Necker named no subordinate taxa corresponding to the species of other authors, Phyllarthus is not typified. If, however, Phyllarthus includes Epiphyllum and Opuntia, it must include the lectotype of Opuntia and hence be a strict synonym of Opuntia. In view of the doubt as to the rank of the taxon and as to its typification, Phyllarthus can scarcely be taken up in place of Epiphyllum. It is most easily disposed of as a doubtful synonym of Opuntia.

EPIPHYLLUM THOMASIANUM, (Schum.) Britt. & Rose

Phyllocactus macropterus, Lem., was described from sterile material: branches bright green, 5–6 dm. long, 10–14 cm. wide, very thick, attenuate at the base and gradually enlarging upward, the crenations ("cyrtomes") 6–7 cm. long, semiorbicular; flowers not seen but said to be very large, resembling those of *P. crenatus,* remaining open two or three days.

Phyllocactus Thomasianus, Schum., was described as having branches 5–8 cm. wide, "klein gekerbt." Schumann (1897a) said that Weber had flowering plants undoubtedly of the same species, which were supposed to be from Lemaire's original plant of *P. macropterus.* Weber (1898) referred *P. Thomasianus* to synonymy under *P. macropterus.* He did not describe the branches, but he said that the flowers opened in the evening and closed the next day. Britton and Rose (1923) described and illustrated *Epiphyllum "macropterum"* from Costa Rican material. They included *P. Thomasianus* in the synonymy, and their description agrees fairly well with Schumann's description of that species. They said nothing of the duration of the flowers, but they described the branches as thin, to 10 cm. wide, with slightly indented margins.

On Schumann's authority, we may assume that *P. Thomasianus* was the same as Weber's plant; and it seems likely that Britton and Rose had the same species. The branches described by Britton and Rose and by Schumann differ from those described by Lemaire in being narrower, thin, and with less rounded lobes. Since the branches of Epiphyllum are often quite variable, these apparent differences may not be important. However, the flowers described by Weber were nocturnal, whereas those of *P. macropterus* were said to last two or three days. It seems possible that in the thirty years following Lemaire's publication, the name on his type plant could have been accidentally transferred to some similar plant. The identity of *P. macropterus* with *P. Thomasianus* thus appears very doubtful, and *P. macropterus* is scarcely identifiable. Therefore, the name *Epiphyllum Thomasianum,* (Schum.) Britt. & Rose should be taken up for the plant described by Schumann and by Britton and Rose.

MALACOCARPUS, Salm-Dyck

Britton and Rose (1922) recognized Malacocarpus, Salm-Dyck, with 29 species. Backeberg and others have transferred a few of these species to Austrocactus, Britt. & Rose, Frailea, Britt. & Rose, Neochilenia, Backeberg, and Parodia, Spegazzini (=Hickenia, Britt. & Rose). Most of the other species they have transferred to six segregate genera: Brasilicactus, Backeberg, Eriocactus, Backeberg, Horridocactus, Backeberg, Islaya, Backeberg, Notocactus, Backeberg & Knuth, and Pyrrhocactus, Backeberg & Knuth. From the diagnoses of these segregate genera and of the species referred to them, some taxonomists would question the worth of these segregates. Even if they are distinct natural groups, which is not always entirely clear, the differences cited for them are mostly not impressive. On the other hand, the problem is not necessarily solved by retaining all the segregates in Malacocarpus. That all the species do not conform to Salm-Dyck's concept of the genus is not important. However, the genus as delimited by Britton and Rose is not homogeneous, and with the addition of the many species since proposed, the distinction of this from other genera becomes even less clear than Britton and Rose left it. From the descriptions available, it is not certain whether a sharp distinction can be made between Malacocarpus and such genera as Parodia, Frailea, Neochilenia, and Discocactus. Because under Malacocarpus various transfers have not been made, Notocactus and Pyrrhocactus will be accepted in Hortus Third despite the uncertainty as to their distinctness.

There is a question whether Notocactus and Pyrrhocactus have been validly published and, if so, by whom. Notocactus was established by Schumann (1898) as a subgenus of Echinocactus. Berger (1929) retained it in this rank but at the same time provisionally raised it to generic rank. In the same way, he proposed Pyrrhocactus as a subgenus and simultaneously as a genus. Later authors recognizing these taxa as genera have credited them both to Berger. There has been some heated discussion as to the validity of Berger's nomenclatural procedure. Croizat (1942) unquestionably is right that the names published in this fashion by Berger are provisional and hence invalid.

Apparently Backeberg and Knuth (1935) were first to take up Notocactus and Pyrrhocactus unequivocally as genera. Considering them as already published by Berger, they gave no Latin diagnoses. Indirectly, however, they referred to Berger's descriptions. Thus in attributing Notocactus to Berger and giving the date "1929," they cited Berger's book, for their bibliography lists only the one work for Berger in 1929. Pyrrhocactus they also attributed to Berger but with the erroneous date "1922." Under Article 42 of the International Code, this error of citation does not invalidate the transfer. It may be argued that if Berger's publication of

Pyrrhocactus as a genus is provisional and hence invalid, his simultaneous publication of it as a subgenus is likewise provisional and invalid. Since the species are listed as Echinocactus species with Pyrrhocactus in synonymy, it may be said that Berger treated Pyrrhocactus primarily as a subgenus; I am, therefore, inclined to accept it as validly published in that rank. However, this question does not affect the validity of its publication in generic rank by Backeberg and Knuth. They indirectly referred to Berger's description, which was effectively published before the time when Latin diagnoses were required. It, therefore, appears that the first publication of Notocactus and Pyrrhocactus as genera was by Backeberg and Knuth in 1935. Various specific transfers, usually attributed to Berger, also were first validated by Backeberg and Knuth.

MAMMILLARIA, Haw.

Buxbaum (1951) argued that Mammillaria in the old sense (Neomammillaria of Britton and Rose) was polyphyletic, and he divided it into several genera. If his views of phylogeny are correct, at least some of his generic segregates must be accepted. Although much of his argument sounds convincing, however, some of his interpretations still seem open to question (Moran, 1953). In any case, the acceptance of all his segregates in Hortus Third is not practicable for several reasons. Chilita, Orcutt, has priority over Ebnerella, Buxb., yet various species have not been transferred to Chilita. Furthermore, it would seem desirable—and not inconsistent with Buxbaum's views of phylogeny—to combine with Chilita such taxa as Bartschella, Phellosperma, and Porfiria; but again the transfers have not been made. Finally, from the information available it is not always possible to know to which segregate genus a given species belongs. Oehmea, Buxb., is provisionally accepted, as would be Mammilloydia, Buxb., had the transfers all been made; even if these taxa are separated from Mammillaria, however, it is not certain that Oehmea should be kept apart from Mammilloydia.

In Hortus Third, therefore, Mammillaria will have much the same limits as before, though with the acknowledgment that in this sense it may be somewhat unnatural. The taxa distinguished by Buxbaum are, however, accepted as subgenera and sections. Several taxa segregated by other authors are also returned to Mammillaria.

The subgenus Mammillaria now corresponds to the section Galactochylus of Schumann's treatment (1897). From the information available, the natural limits of this subgenus are not certain, nor is it certain whether all species properly belonging to it have latex. The section Galactochylus is retained for those species having latex in the tubercles, whereas those having watery juice in the tubercles are segregated in the section

Conothelæ, Salm-Dyck. Although this distinction seems useful in the classification, it is not definitely known to be natural.

Mammillaria, Haw. Syn. Pl. Succ. 177 (1812), *nomen conservandum.*

† Subgen. **Bartschella,** (Britt. & Rose) Moran, stat. nov.
Bartschella, Britt. & Rose, Cactaceae, iv, 57 (1923), *pro gen.*

† Subgen. **Chilita,** (Orcutt) Moran, stat. nov.
Chilita, Orcutt, Cactography, 2 (1926), *pro gen.*

† Subgen. **Mammilloydia,** (Buxb.) Moran, stat. nov.
Mammilloydia, Buxb. in Oesterr. Bot. Zeitschr. xcviii, 64 (1951), *pro. gen.*

† Subgen. **Porfiria,** (Böd.) Moran, stat. nov.
Haagea, Frič, in Život v Přírodě, xxix, 36–37 (1925), not Klotzsch (1854).
Porfiria, Böd. in Zeitschr. f. Sukkulentenk. ii, 210 (1926), *pro gen.*

† Subgen. **Solisia,** (Britt. & Rose) Moran, stat. nov.
Solisia, Britt. & Rose, Cactaceae, iv, 64 (1923), *pro gen.*

† Sect. **Phellosperma,** (Britt. & Rose) Moran, stat. nov.
Phellosperma, Britt. & Rose, Cactaceae, iv, 60 (1923), *pro gen.*

† Sect. **Pseudomammillaria,** (Buxb.) Moran, stat. nov.
Pseudomammillaria, Buxb. in Oesterr. Bot. Zeitschr. xcviii, 84 (1951), *pro gen.*

† **Mammillaria coahuilensis,** (Böd.) Moran, trans. nov.
Haagea Schwarzii, Frič, in Život v Přírodě, xxix, 26–27 (1925), not *Mammillaria Schwarzii,* Shurly (1949).
Porfiria coahuilensis, Böd. in Zeitschr. f. Sukkulentenk. ii, 210 (1926).

MEDIOCACTUS, Britt. & Rose

In founding the genus Mediocactus, Britton and Rose (1920) said that it resembled Hylocereus in its habit and flowers and Selenicereus in its tuberculate ovary and in the felted and spiniferous areoles of the fruit. In Mediocactus the stems have 3 to 5 angles or wings; in Selenicereus they usually have several ribs or angles, but they may have as few as 3. To judge from descriptions and illustrations, the flowers of Mediocactus are essentially like those of some species of Selenicereus. Probably Werdermann (1933) was justified in combining Mediocactus with Selenicereus.

Cereus coccineus, Salm-Dyck, and *C. setaceus,* Salm-Dyck, published simultaneously, apparently were first combined as *C. setaceus* by Pfeiffer

in 1837. If so, the epithet "setaceus" must be used for this species, as it was by Werdermann. The transfer has not been made under Mediocactus. Whether Mediocactus is retained or placed in Selenicereus, one transfer is necessary. Therefore: † **Selenicereus megalanthus,** (Schum.) Moran, trans. nov. (*Cereus megalanthus*, Schum. ex Vaupel, in Monatsschr. f. Kakteenk. xxiii, 182, 1913).

OPUNTIOIDEÆ, Schum.

In the Opuntioideæ, Pterocactus and Tacinga stand out as strong genera. Among the other segregates of Opuntia are taxa showing such varying degrees of differences and distinctions that it is difficult to know where to draw the line in recognizing them. The Mexican Pereskiopsis seems a well-marked group even if the best key character is the flatness of the leaves. Quiabentia is a South American counterpart; but the information available does not permit even a tentative decision as to whether this had a common origin with Pereskiopsis and can be treated as a subgenus or whether it is a parallel development.

To judge from the observations of Porsch (1938), Nopalea may be regarded as a Platyopuntia adapted to pollination by hummingbirds. Presumably it is genealogically closer to Platyopuntia (Opuntia subgen. Opuntia) than that is to Cylindropuntia. It is, therefore, questionable whether Nopalea can logically be maintained as a genus while Cylindropuntia is kept in Opuntia. Brasilopuntia and Consolea are well-marked taxa possibly bearing a similar relationship to Platyopuntia and Cylindropuntia, though their indeterminate main axis makes such a relationship more doubtful.

Engelmann (1859) considered his subgenus Cylindropuntia very distinct vegetatively but decided not to separate it as a genus because "the flowers are so entirely identical and in the fruit so little difference is observed." He added that the only real distinction appeared to be in the embryo, which in Cylindropuntia "is less curved, not completing an entire circle."

Britton and Rose (1919) remarked that Opuntia as they circumscribed it included a great range of stem structure, suggesting different generic types, but that intergradation prevented the segregation of genera. To what extent this intergradation is real and to what extent apparent remains a matter for investigation. Though some members of the subgenus Opuntia (Platyopuntia) may have subterete or even terete joints, these presumably are always determinate and subequal in length. Thus these plants are quite different from the typical Cylindropuntia with its indeterminate main axis and progressively shorter branches. However, Corynopuntia and Tephrocactus, segregates of Cylindropuntia, both have determinate joints throughout, and possibly this is true of some other

species of Cylindropuntia as well. Whether any absolute distinction can be made between Opuntia and Cylindropuntia on the basis of fruit and seed characters is not clear.

In Hortus Third, generic lines in the Opuntioideæ will be those used by Britton and Rose, though some changes will be made in the infrageneric classification of Opuntia.

† **Opuntia** sect. **Austrocylindropuntia,** (Backeberg) Moran, stat. nov. *Austrocylindropuntia*, Backeberg, Blät. f. Kakteenf. 1938, pt. 6, [7, 21] (1938), *pro gen.*

DeCandolle (1828) founded the section Cylindraceæ of Opuntia. Since the ending "aceæ" is now reserved for family names, this section may be called "Cylindricæ", as it was by Engelmann (1856). In this section DeCandolle included three species: *O. rosea*, DC., from Mexico, *O. cylindrica*, (Lam.) DC., from Peru, and *O. imbricata*, (Haw.) DC., of unknown origin. Though *O. rosea* is definitely identifiable from the original plate, whereas *O. imbricata* apparently is known only from the scanty original description, most authors identify *O. rosea* with the earlier *O. imbricata*. Although DeCandolle made no reference to sheaths of the spines, *O. rosea* belongs to a northern taxon with sheathed spines and *O. cylindrica* to a southern taxon with sheathless spines. Since these taxa will be treated as two sections, it is necessary to select a type species for DeCandolle's section.

Engelmann (1856, 1859) founded the subgenus Cylindropuntia with the sections Clavatæ and Cylindricæ. Although he gave no authorities for sections, it may perhaps be assumed that "Cylindricæ" is a corrected spelling for DeCandolle's "Cylindraceæ." Engelmann defined the Cylindricæ as having sheathed spines: thus, whether intentionally or not, he eliminated from this section *O. cylindrica*, a species not coming within the range of his treatment. His treatment also failed to include the other two of DeCandolle's species, but he stated in the Corrections (1859) that *O. arborescens*, Engelm., seemed to be very close to, if not identical with, *O. rosea* and *O. imbricata*.

Knuth (Backeberg & Knuth, 1935), founding the genus Cylindropuntia, gave no Latin diagnosis but referred to Engelmann's description of Opuntia subgenus Cylindropuntia. Therefore, the type species of his genus must be the same as that of Engelmann's subgenus. Knuth named *O. imbricata* as the type. This selection might be criticized because the species did not appear in Engelmann's treatment. However, the type species of the subgenus must be the same as that of the typical section Cylindricæ and hence must be one of DeCandolle's three species. The only question is whether Knuth made a correct choice among the three.

The similarity of the sectional name to the specific epithet might sug-

gest the selection of *O. cylindrica* as the type of the Cylindricæ. The best course, however, is to accept Engelmann's limitation of the section and to name a northern species as the type. *Opuntia rosea*, which is definitely identifiable, would seem to be the best choice. So long as *O. rosea* is identified with *O. imbricata*, however, there is no reason to disagree with Knuth's selection. Therefore, *O. imbricata* is accepted as the type species of the subgenus Cylindropuntia, Engelm., and of the section Cylindricæ, DC.

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ARTICLE 15.
TAXONOMIC STUDIES IN THE CACTACEÆ.

II—NOTES ON SCHLUMBERGERA, RHIPSALIDOPSIS, AND ALLIED GENERA.

By Reid Moran

The widely grown Christmas cactus has been known in this country by two different names each properly belonging to a different plant. Though cactus fanciers know these names are incorrect, they have not found a correct one. Search for a correct name for this plant has led to comparison of the several genera proposed in this part of the cactus family. As a result, the genera Schlumbergera and Rhipsalidopsis are redefined and their relationships discussed.

Thanks are extended to Mr. and Mrs. Sherman E. Beahm, of the Beahm Gardens, Pasadena, who specialize in epiphytic cacti; they have kindly sent plants and answered many questions.

SCHLUMBERGERA, Lem. in Rev. Hort. xxx, 253 (1858).

Epiphyllum, Haw. emend. Pfeiffer, Enum. Cact. 127 (1837), not *Epiphyllum*, Haw. (1812).

Zygocactus, Schum. in Mart. Fl. Bras. iv, pt. ii, 223 (1890).

Zygocactus sect. *Leptoarticulatæ*, Löfgren, in Arch. Jard. Bot. Rio de Janeiro, ii, 23 (1918).

Epiphyllum subgen. [?] *Zygocactus*, Berger, Kakteen, 98 (1929).

Epiphytic Brazilian cacti: stems of determinate joints, the joints mostly flat (2-winged, rarely 3-winged), oblong to obovate, truncate, each margin with 1–4 areoles in the axils of acute to rounded serrations, the apex with several crowded areoles from which arise most flowers, new joints, and aerial roots; spines none or few, short, setaceous: flowers white to red or purplish, pendent or with the tube turned horizontal, open for several days and nights, odorless, regular to zygomorphic; ovary obconic, terete or ribbed, mostly naked; perianth-segments about 20–30, petaloid, the outer short, free, the next inner gradually longer and increasingly fused, the inner subequal, united to the middle into a thin-walled cylindric to laterally flattened tube, whose mouth is strongly to not at all oblique; stamens and style well exserted from the mouth; stamens about 30–100, inserted from the base nearly to the mouth of the perianth-tube, an inner series of about 10–20 united by their bases into a short tube around the style; stigma-lobes 5–8, erect, connivent: fruit umbilicate after abscission of the upper floral parts, juicy; seeds small, obovate, dark, shining; embryo curved.

Schlumbergera is defined here as Epiphyllum was defined in the treatments of Weber (1896) and Schumann (1903). Since, however, the original species of Epiphyllum, *E. Phyllanthus*, does not belong here, the name Epiphyllum cannot be used for this taxon: it must be retained, as it was by Britton and Rose (1913, 1923), for the taxon to which *E. Phyllanthus* belongs, namely that known to Weber and Schumann as Phyllocactus.

As shown in the key, *Schlumbergera truncata* differs from *S. Bridgesii* and *S. Russelliana* in several characters whose total may, in this family, seem impressive. Nevertheless, they are more similar to each other than to any other species, and they are said to hybridize with each other, though none of them is known to hybridize with any other species. The Christmas cactus, *S. Bridgesii*, though agreeing with *S. Russelliana* in most characters, is similar enough to *S. truncata* to have been confused with it for years. Here, then, is a place where genera may well be consolidated.

1. Ovary terete; corolla strongly zygomorphic, the tube laterally compressed, its axis mostly horizontal, turned sometimes 45° or more from the axis of the ovary; stamens bowed against the upper side of the tube; inner staminal tube with an inner deflexed membrane; anthers yellow: joints mostly serrate-dentate on the margins.....Subgen. ZYGOCACTUS
S. truncata

1. Ovary 4–6-angled or -winged; corolla regular to slightly zygomorphic, the tube terete, its axis declined, nearly a continuation of the axis of the ovary; stamens not bowed to one side of the tube; inner staminal tube without an inner membrane; anthers purplish: joints obliquely crenate on the margins.....Subgen. SCHLUMBERGERA

2. Stamens of the inner series about 10; flowers 5–6.5 cm. long; perianth-segments about 20–25, 6–7 mm. wide, ascending to spreading: joints 2–3.5 cm. long, .5–1.5 cm. wide, each margin 1–2-crenate.....*S. Russelliana*

2. Stamens of the inner series about 14–18; flowers 6–7.5 cm. long; perianth-segments about 25–30, 8–12 mm. wide, the outer ones strongly recurved: joints mostly 3–5 cm. long and 1.5–2.5 cm. wide, each margin commonly 2–3-crenate.....*S. Bridgesii*

† **Schlumbergera** subgen. **Zygocactus,** (Schum.) Moran, stat. nov.

Zygocactus, Schum. in Mart. Fl. Bras. iv, pt. ii, 223 (1890), *pro gen.*

Zygocactus sect. *Leptoarticulatæ*, Löfgren, in Arch. Jard. Bot. Rio de Janeiro, ii, 23 (1918).

Epiphyllum subgen. [?] *Zygocactus*, Berger, Kakteen, 98 (1929).

In this subgenus, besides innumerable horticultural varieties, at least three supposedly indigenous species and one indigenous variety have been named. Most authors have considered that all these plants are best included in one species, and that view is accepted here. At present it is uncertain how many subspecies, varieties, and horticultural varieties should be recognized.

† **Schlumbergera truncata,** (Haw.) Moran, trans. nov.

Epiphyllum truncatum, Haw. Suppl. Pl. Succ. 85 (1819).

† **Schlumbergera truncata** var. **Altensteinii,** (Pfeiffer) Moran, trans. nov.

Epiphyllum Altensteinii, Pfeiffer, Enum. Cact. 128 (1837).

Epiphyllum truncatum var. *Altensteinii,* Lem. Cact. Gen. Nov. Sp. 76 (1839).

† **Schlumbergera truncata** var. **delicata,** (N. E. Br.) Moran, trans. nov.

Epiphyllum delicatum, N. E. Br. in Gard. Chron. ser. 3, xxxii, 411 (1902).

Zygocactus truncatus var. *delicatus,* Backeberg & Knuth, Kaktus-ABC 160 (1935).

Schlumbergera subgen. **Schlumbergera.**

Schlumbergera, Lem. in Rev. Hort. xxx, 253 (1858).

Epiphyllum subgen. [?] *Schlumbergera,* Berger, Kakteen, 97 (1929).

Schlumbergera Russelliana, (Gardner) Britt. & Rose, in Contr. U. S. Nat. Herb. xvi, 261 (1913).

Epiphyllum Russellianum, (Gardner) Hook. in Bot. Mag. t. 3717 (1839).

Cereus Russellianus, Gardner ex Hook. l. c. (1839), *pro syn.;* Gardner ex Lem. in Hort. Univ. i, 31 (1839).

Phyllocactus Russellianus, Salm-Dyck, Cact. Hort. Dyck, 1844, 37 (1845).

Epiphyllum truncatum Russellianum, G. Don, in Loudon, Encyc. Pl. Ed. 3, 1378 (1855).

Schlumbergera epiphylloides, Lem. in Rev. Hort. ser. iv, vii, 253 (1858).

Schlumbergera Russelliana was discovered by George Gardner in the Organ Mountains of Brazil in May 1837 (Johnson, 1944) and was introduced into cultivation in England soon after. Under the name of *Cereus Russellianus,* Gardner sent to W. J. Hooker a description of the plant and a drawing of a handsome flowering specimen; these Hooker (1839) published as *Epiphyllum Russellianum.*

The plant remained rare in Europe and rarely flowered. Schumann (1897a) said that though it was listed in nursery catalogues, it was not to be found in Germany. Weber (1900) also remarked on its rarity, adding that in the collection of M. Schlumberger, of Rouen, plants of the original introduction had flowered only once or twice in forty years. Weber saw and described a single flower, which he found to agree exactly with the original description except for slightly smaller size.

Schlumbergera Bridgesii, (Lem.) Löfgren, in Arch. Jard. Bot. Rio de Janeiro, ii, 32 (1918).

Epiphyllum Bridgesii, Hort. ex Lem. in Ill. Hort. viii, Misc. 5 (1861).

Epiphyllum Ruckerianum, Hort. ex Lem. l. c. *pro syn.*

?Epiphyllum truncatum var. *Bridgesii*, Rümpl. in Först. Handb. Cact. Ed. 2, 870 (1886).

Epiphyllum Rueckeri, [attributed to Paxt. by] Schum. Monatsschr. f. Kakteenk. vii, 52 (1897), not *E. Ruckeri*, Paxt. (1845).

Epiphyllum Rueckerianum, Hort. ex Berger, Kakteen, 98 (1929), *pro syn.*

Epiphyllum Ruckeri, Guill. in Chouard & Laumonnier, Bon Jard. Ed. 151, 1838 (1947), not Paxt. (1845).

Branches arching, to 4 dm. long; joints oblong to obovate, truncate, cuneate at the base, 2–5 cm. long, 1.5–2.5 cm. wide, each margin obliquely 1–3-crenate, the apex producing 1–5 joints, mostly solitary flowers, and sometimes aerial roots: flowers pendent, open for about 8 days and nights, 6–7.5 cm. long, 5–6 cm. wide; ovary yellowish-green or slightly rosy, obconic, unequally 4–6-angled, 7–10 mm. long, 5–8 mm. wide, the angles mostly somewhat winged, sometimes 1-crenate and 1-areolate, continued upward into the first short outer floral scales, but the top of the ovary rather clearly delimited from these scales by the difference in color; perianth brilliant Tyrian rose; outer floral scales and perianth-segments of gradually increasing length, the lower 5 commonly deltoid and less than 1 cm. long, free, the next 5–10 ovate to broadly lanceolate, 1–4 cm. long, 8–12 mm. wide, nearly free, spreading or somewhat reflexed, the next 5 or so elliptic-lanceolate, 4–6 cm. long, about 12 mm. wide, increasingly fused at the base, the apices spreading or reflexed, the inner segments about 8–12, nearly equal, 5–6 cm. long, 8–12 mm. wide (the innermost narrowest), fused into a tube 2.5–3 cm. long, with the tips wide-spreading or slightly reflexed, the mouth of the tube slightly but noticeably oblique, marked with a dentate line seeming to represent the tips of an inner series of segments; stamens exserted 2–2.5 cm. from the throat, the outer series of about 50 inserted on the inner surface of the perianth-tube at from .5–2.5 cm. above the base, the inner series of about 14–18 slightly shorter, inserted at the base of the corolla-tube, connate for about 3 mm. into a tube around the style; filaments white or somewhat purplish above; anthers lavender; style purple 5–5.5 cm. long, about equalling the longest filaments; stigma-lobes 5–7, erect and not separating: fruit (fide Schumann) red, taking a year to ripen. Flowers mostly December to February in the northern hemisphere.

The description given above for *Schlumbergera Bridgesii* applies to the widely grown Christmas cactus. This plant, as it appears in general cultivation in this country, is rather uniform in its characters. In plants of Christmas cactus grown by cactus fanciers, according to Mr. and Mrs. Beahm, flower color ranges from pink through dark rose-red to magenta, and the flowering period is from the last of November to the first of April and sometimes later.

With regard to the time of flowering of the Christmas cactus, the

experiments of Roberts and Struckmeyer (1939) may be mentioned. High temperatures (70–75° F.) suppressed flowering regardless of day length. At medium temperatures (63–65° F.) flowering was induced by short day length, in a typical photoperiod reaction. At low temperatures (about 55° F.) there was some tendency toward flowering regardless of day length. Thus through controlled light and especially through controlled temperature, the Christmas cactus can be induced to flower at any time of year.

The origin of the Christmas cactus is a matter of dispute. According to Weber (1896) it came into the trade about 1850. Lemaire (1868), who called it *Epiphyllum Bridgesii*, Hort., gave Bolivia as its native land, presumably because Bridges did much of his work in Bolivia. Schumann (1903) believed it native to Brazil because he identified it with Sellow's Brazilian collection which he had mentioned (1897) under the name of *E. obovatum*, Engelm. However, Britton and Rose (1923) and Vaupel (1926) identified this specimen with *Epiphyllopsis* (or *Epiphyllum*) *opuntioides*. Thus there is no clear evidence that the Christmas cactus is a wild species. On the other hand, Weber (1896) described it as intermediate between *Epiphyllum Russellianum* and *E. truncatum* and thought it must be a hybrid. Schumann (1897a) at first agreed to this origin, and Vaupel (1926) and Berger (1929) also thought it possible. Thompson (1900) illustrated a plant of this general appearance as *E. truncatum* × *Russellianum*, though he did not say whether its hybrid origin was known or merely presumed.

Dr. Charles H. Uhl of Cornell University has kindly investigated meiosis in the Christmas cactus. He finds 11 gametic chromosomes, the largest of which is about twice as long as the smallest. In the many good figures examined there is no noticeable irregularity in meiosis.

Stockwell (1935) reported a somatic number of 22 for *Schlumbergera Russelliana*. Inasmuch as that species is not known to be grown in this country, it may be that he had the Christmas cactus instead. His count agrees with Dr. Uhl's. Since, however, there appears to be no voucher at the Dudley Herbarium, this point must remain unsettled.

Sugiura (1936) reported a somatic number of 24 for *Epiphyllum truncatum*, but there is some reason to question this count. His drawing (fig. 108) shows some overlapping of chromosomes, and it is possible that one chromosome was interpreted as two. Furthermore, it seems possibly significant that the three species of cacti studied by Sugiura in his broad survey are the only members of the Cereæ for which numbers based on 12 have been reported. The other two of his species are in Mammillaria, other species of which have been found to have $n = 11$ like most species reported for this tribe. It, therefore, appears that Sugiura's counts should not be accepted without verification.

If Sugiura's report is correct, then according to Dr. Uhl's study, the Christmas cactus can scarcely be a hybrid involving *S. truncata*. If Sugiura's count is questioned, the cytological evidence does not permit such a strong statement; however, it gives no reason whatsoever to suspect hybridity and, if anything, somewhat favors non-hybridity. Since the Christmas cactus is not exactly intermediate but agrees much more closely with *S. Russelliana* than with *S. truncata*, the morphological evidence likewise is against hybridity.

There has been much uncertainty and debate as to the correct name for the Christmas cactus. For over sixty years it has been misidentified in this country as *Epiphyllum* (or *Zygocactus*) *truncatum*, which now is also grown here, mostly under its proper name. Bailey (1949) described *Z. truncatus* correctly, but his figure 140B, labeled *Z. truncatus*, shows the more common Christmas cactus. Evidently this also is the plant that Buxbaum (1938), in a study of its floral morphology, called atypical *Z. truncatus*. On the other hand, it has sometimes been misidentified as *Schlumbergera Russelliana*, as by Britton and Rose (1913, pl. 81). Cactus fanciers in this country know that it is neither *Z. truncatus* nor *S. Russelliana*, but they have been unable to decide what it is.

In Europe, the Christmas cactus has been called *Epiphyllum Bridgesii*, *E. Ruckeri*, or *E. Ruckerianum*. Although these names seem not to have been taken up in this country and rarely appear in recent European cactus literature, they are still sometimes used in the general horticultural literature of Europe.

Apparently the first and principal reference to *Epiphyllum Ruckeri* was by Paxton (1845), who wrote, "It is, undoubtedly, nothing more than an improved variety of *E. truncatum* and exactly accords with that species in every respect except the colour of the flowers, which display . . . a rich violet merging into a fine crimson". Whether or not Paxton was correct in this statement, at least he gave no information that could possibly lead to the identification of *E. Ruckeri* with any plant other than *S. truncata*.

Moore (1852) named three hybrids, which somewhat resemble the Christmas cactus. He described and illustrated *Epiphyllum Buckleyi* and *E. Rollissonii* and also mentioned *E. cupreum*. According to W. Buckley, who had raised these hybrids, all three were from a single pollination of *E. Russellianum* by "a variety of *truncatum* called *Ruckerianum*." Buckley added that in time of flowering, the hybrids were intermediate between the parents, the flowers opening in January, fully two months after those of *E. truncatum*, and that, unlike *E. Russellianum*, the hybrids were free flowering. The two plants shown in Moore's plate resemble the Christmas cactus in the form of their joints, in the angulation of their ovaries, and (especially *E. Rollissonii*) in the form of their corollas.

It may be questioned whether the pollen parent was really *S. truncata*. The joints of the hybrids are shown as obliquely crenate like those of the Christmas cactus. Since Moore said that both hybrids had "stems as in truncatum," the joints of the pollen parent presumably were also crenate and not dentate as in typical *S. truncata*. Furthermore, the epithet "Ruckerianum" that was used for this parent, though not yet formally published, was later applied to the Christmas cactus. These facts may suggest that the pollen parent was not *S. truncata* but actually the Christmas cactus.

On the other hand, several floral characters of the pollen parent, stated or implied in Buckley's comparison of the hybrids with the parents, are not those of the Christmas cactus. He said that in the hybrids the ovary was angled as in the seed parent and the stamens were straight as in the seed parent; thus he seems to imply that in the pollen parent the ovary was terete and the stamens were bowed. And he said that the flowers of the hybrids were "entirely free of that peculiar ringent appearance which is characteristic of the flowers of truncatum." It would, therefore, appear that the plant which Buckley called *E. truncatum* var. *Ruckerianum*, and which he used as a pollen parent, was like the Christmas cactus in its joints and like *S. truncata* in its flowers. If so, it was not the Christmas cactus, to which the name *E. Ruckerianum* was later applied. Rather, it must have been similar to *Zygocactus truncatus* var. *crenatus*, Borg, which was described much later and was said to be a native variety. If the pollen parent was a native variety of *S. truncata*, it appears to have been one of which there is no other record for the next eighty-five years. Quite possibly the pollen parent was itself a hybrid of the Christmas cactus and *S. truncata*.

If it could be shown that the Christmas cactus was a hybrid between *S. Russelliana* and any form or variety of *S. truncata*, one of Moore's epithets would have to be taken up for it. Evidence bearing on this question could be obtained by attempting to cross *S. Russelliana* with *S. truncata* or, better, with the plant that Borg called *Zygocactus truncatus* var. *crenatus*. If a hybrid was obtained which resembled the Christmas cactus and which had regular meiosis, there would be reason to suppose that this was indeed the origin of the Christmas cactus. Since, however, there is now no evidence for such an origin, Moore's epithets will not be used.

Lemaire's original description of *Epiphyllum Bridgesii* and accompanying observations may be combined and freely translated as follows: Stems jointed, the joints flat, fleshy, light green, oblong, squarely truncate, subattenuate at the base, 4.5–5.5 cm. long, 2–3 cm. wide, each margin 2–3 crenate-lobulate, quite edentate, the central rib raised, the apex with a linear series of subdistant brown bristles, of which there is also a bunch

in the axil of each lobe: flowers terminal, solitary or rarely paired, opening "le soir" [afternoon? evening?] and lasting six to eight days, bright and shining rose-violet, 4.5–5 cm. long, 6 cm. wide at the apex; ovary naked, olive-green, short-obconic, horizontally compressed, with 4–5 acute wings which rarely are 1–2-lobulate and with slender bristles; perianth-tube comparatively short, cylindric and not compressed, obliquely hexagonal at the mouth, the segments "subito magnis" [perhaps meaning that there are relatively few small outer ones], oblong-lanceolate, erect with the apices spreading but scarcely recurved, the inner narrower, not recurved at the apex; stamens exserted, unequal, rosy, the outer series longer, united to the middle with the perianth-tube, the others free; style violet, scarcely exceeding the stamens; stigma-lobes 5, not expanding. Flowers in December, January, and February. Received from M. L. Desmet, of Ghent, who had it from Holland under the name of *E. Bridgesii*, suggesting that it was discovered and introduced by Bridges. M. Schlumberger received it as *E. Ruckerianum*.

Lemaire, who had established the genus Schlumbergera three years before, now compared *E. Bridgesii* with Schlumbergera. He wrote (in free translation), "The principal botanical characters of *E. Bridgesii* are: the articulation of the stems, the naked short obconic ovary, the solitary flowers, the exserted stamens, of which the first series is united to the middle with the tube, etc.: all characters, except the articulation of the stems, that differentiate it from Schlumbergera, which has regular flowers, stamens included and free, etc."

Though the original description leaves some uncertainty as to floral structure and especially dimensions, it does give many details. So far as it goes, it agrees fairly well with the Christmas cactus. There are five possible discrepancies, namely in the size of the joints, the length of the flowers, the length of the perianth-tube, the attitude of the perianth-segments, and the freedom of the inner stamens.

The joints of *E. Bridgesii* are described as 4.5 to 5.5 cm. long and 2 to 3 cm. wide. The joints of Christmas cactus may be 5 cm. long and 2.5 cm. wide or possibly more. However, they certainly are often shorter than 4.5 cm. and narrower than 2 cm.

The flowers of *E. Bridgesii* are described as 4.5 to 5 cm. long and 6 cm. wide "au sommet." Since "sommet" obviously refers not to the exserted stigma but to the summit of the expanded corolla, it may be that the length of the flower also was measured to this point and hence did not include the exserted stigma and stamens. Under this interpretation, the flowers, like the joints, were rather large for the Christmas cactus, but not impossibly large: otherwise, they were too small.

The corolla-tube of *E. Bridgesii* is described as comparatively short, but there is no definite measurement. From the rest of the description,

however, it appears that it must have been nearly if not quite as long as in the Christmas cactus. The ovary was "short-obconic"; and had it been much longer than in *S. truncata*, this would have called for comment in the comparison with that species: we may, therefore, assume that the ovary was less than 1.5 cm. long and probably not over 1 cm. If the flower length of 4.5–5 cm. was measured to the tips of the exserted stamens, the distance from the top of the ovary to the tips of the stamens, therefore, probably was between 3 and 4 cm. The outer stamens were united to the middle with the tube, that is probably for 1.5 to 2 cm. Therefore, the tube probably was at least 1.5 to 2 cm. long. If, on the other hand, it is assumed that the flower length was measured to the summit of the corolla, then the exserted stamens and hence the corolla-tube must have been longer. If the corolla extended little beyond the tube proper, then the tube may have been about 3 cm. long.

The tips of the perianth-segments of *E. Bridgesii* are described as spreading but scarcely reflexed. In the Christmas cactus, the perianth-segments may be reflexed nearly if not quite as much as most segments of *S. truncata*, though not so much as the lower lip segments of that species.

The inner stamens of *E. Bridgesii* are described as free. However, this means not that they were free from each other (non-connate) but that they were free from the perianth-tube (non-adnate). Lemaire was well aware that the inner stamens of *Schlumbergera Russelliana* were connate, for when he established the genus he emphasized this condition. It is, therefore, clear that when he said, as quoted above, that the stamens of Schlumbergera were free, he meant that they were non-adnate. Comparison with this statement shows that in the description of *E. Bridgesii* also he could only have meant that the inner stamens were non-adnate. (Actually Lemaire was wrong in saying that [all] the stamens of Schlumbergera were non-adnate, for in the original description and in Weber's description the outer stamens are said to be united to the middle with the tube.)

The question may arise why, if the inner stamens were connate in *E. Bridgesii*, Lemaire did not include this species in Schlumbergera, which three years before he had said was unique in the family in its connate inner stamens. Evidently Lemaire was casting about for characters to differentiate *E. Bridgesii* from Schlumbergera, and the results as explained below are not impressive. Therefore, if the inner stamens of *E. Bridgesii* were non-connate, he surely would have mentioned this fact. Lacanal (1861) pointed out that an inner staminal tube was present in *E. Ruckerianum* and *E. truncatum* as well as in *E. Russellianum*. Although Lemaire (1861) quibbled mightily, he failed to tell how the stamens of Epiphyllum differ from those of Schlumbergera.

Thus the Christmas cactus differs from the description of *E. Bridgesii* in having somewhat smaller joints and more reflexed perianth-segments

and possibly shorter flowers. Because of the close agreement in many other details, it appears that the Christmas cactus must be very closely related to *E. Bridgesii*, and it is assumed that they are not specifically distinct.

Apparently, then, Schumann (1903), Vaupel (1926), and Berger (1929) were justified in identifying the Christmas cactus with *Epiphyllum Bridgesii*. Weber (1896) had made the same identification, though he took up the name "E. Ruckerianum", attributing it to Paxton.

Lemaire's comparison of *E. Bridgesii* with Schlumbergera is quoted above. The implied differences in shape of ovary, number of flowers to a joint, and adnation of stamens are not borne out by the original description and illustration of *S. Russelliana* or by Weber's (1900) description based on a plant of the original introduction. Although the stamens are shown in the original plate as more or less included, they are described by Weber as exserted 1 cm., the difference being due merely to a greater spreading of the perianth. Thus there remain no characters to keep *E. Bridgesii* out of Schlumbergera, even if the genus were not defined here in a broader sense. In fact, the question might be raised whether *S. Bridgesii* is not a subspecies or variety of *S. Russelliana*. The differences given above in the key are not great. Cultivated material of the two probably was derived from few introductions—perhaps only two. Only the study of a series of field-collected plants can show whether the two are distinct. For the present, however, *S. Bridgesii* seems best maintained as a separate species.

EPIPHYLLANTHUS, Berger, in Rep. Mo. Bot. Gard. xvi, 84 (1905).
Zygocactus, sect. *Pachyarticulatæ*, Löfgren, in Arch. Jard. Bot. Rio de Janeiro, ii, 23 (1918).

In the three named species of Epiphyllanthus the perianth is tubular and irregular, the inner stamens are united at the base into a tube with an inner deflexed membrane, and the stigma-lobes are erect and connivent. Thus in floral structure these species are close to *Schlumbergera truncata*. In their angled ovaries they differ from *S. truncata* and agree with *S. Russelliana* and *S. Bridgesii*. In vegetative structure, however, they differ considerably from Schlumbergera. The joints are cylindric or flattened and bear areoles spirally over their whole surface. Thus, as pointed out by Berger (1926), even the flattened joints of *E. opuntioides* are not comparable to those of Schlumbergera, which are two-winged, with areoles only on the margins.

According to Löfgren (1918), an unpublished drawing by Barbosa-Rodrigues shows a plant, probably from Itatiaya, resembling *E. opuntioides* but with nearly regular perianth and with no membrane in the staminal tube. Thus two differences between the two subgenera of Schlumbergera apparently are paralleled in species of Epiphyllanthus.

From the similarity of floral structure and from the fact that the stems of both are of short determinate joints, it is probable that Schlumbergera and Epiphyllanthus are closely related. However, Knebel, a noted hybridizer, reported (1951) that he did not succeed in crossing *Epiphyllanthus obtusangulus* with Epiphyllum (=Schlumbergera in the present sense). It may be that Epiphyllanthus and Schlumbergera should be united, as was done by Vaupel (1926) under Epiphyllum and in part by Löfgren (1918) under Zygocactus. Until a closer study is possible, however, they are kept separate on the basis of the difference in gross stem structure.

† **Epiphyllanthus opuntioides,** (Löfgren & Dusén) Moran, trans. nov.

?Epiphyllum obovatum, Engelm. ex Schum. Gesamtbeschr. Kakt. 224 (1897), *nomen provis.*

Epiphyllum opuntioides, Löfgren & Dusén, in Arch. Mus. Nat. Rio de Janeiro, xiii, 49 (1905).

Zygocactus opuntioides, Löfgren, in Arch. Jard. Bot. Rio de Janeiro, ii, 26, t. 4 (1918).

Epiphyllum polycanthum, Barb.-Rodr. ex Löfgren, op. cit. 27, *pro. syn.*

?Epiphyllanthus obovatus, Britton & Rose, Cactaceae, iv, 180 (1923).

Schumann's original publication of *Epiphyllum obovatum* may be freely translated as follows: "In the [Berlin] Botanical Museum is another true Epiphyllum, collected by Sellow in Brazil. It has obovate joints with almost entire margins and a delicate completely zygomorphic flower. Engelmann saw this specimen and annotated it *E. obovatum*, Engelm. Since the scanty and valuable material does not permit a description to be made, I will now only point out that another species should be founded on it." Although Schumann described *E. obovatum* as having "vollkommen" zygomorphic flowers whereas in his key (1903) he described *E. Bridgesii* has having "wenig" zygomorphic flowers, he said (1903) that Sellow's specimen was no different from *E. Bridgesii*. However, Britton and Rose (1923) and Vaupel (1926) identified this specimen with *E. opuntioides*, Vaupel stating that the joints bore areoles over the surface as well as on the margins. Although the original description of *E. obovatum* is very brief, Schumann then considered the species distinct and he cited a definite specimen. Since, however, he clearly considered that he was not founding a species, mention of the name "E. obovatum" is incidental, and the name is not validly published. Consequently, *E. opuntioides*, Löfgren & Dusén, remains the earliest valid name for the present species.

RHIPSALIDOPSIS, Britt. & Rose, Cactaceae, iv, 209 (1923).

Rhipsalis, Gruppe *Gaertnerianæ*, Vaupel, in Engler & Prantl, Nat. Pflanzenfam. Ed. 2, xxi, 619 (1925).

Epiphyllum, subgen. [?] *Epiphyllopsis*, Berger, Kakteen, 97 (1929).

Epiphyllopsis, Berger, op. cit. 97, 341, *nomen gen. provis.*; Backeberg & Knuth, Kaktus-ABC, 158 (1935).

Epiphytic Brazilian cacti: stems of determinate joints, the joints short, 2–6-angled or -winged, the upper mostly flat (2-winged), oblong, each margin obliquely 2–6-crenate with an areole in each notch, the apex with several crowded areoles from which arise most flowers and new joints; spines setaceous: flowers opening several successive days, regular, pink or red, odorless (?) or fragrant; ovary naked, angled; perianth-segments about 12–20, petaloid, scarcely united, more or less spreading; stamens numerous, inserted in one series at the base of the perianth; stigma-lobes 3–7, free, spreading: fruit * umbilicate after abscission of the upper floral parts, at first with scant flesh, persistent and becoming dry, at last apically circumscissile; seeds * semi-ovate, acute at both ends, brown, shiny.

1. Flowers rose-pink, horizontal, fragrant; longest perianth-segments lanceolate, broadly acute, to 2 cm. long; stigma-lobes 3–4: joints 2–4 cm. long, each margin with 2–4 crenations..... *R. rosea*

1. Flowers bright red, pendent, odorless (?); longest perianth-segments linear-lanceolate, slender-acute, 2.5–4.5 cm. long; stigma-lobes 5–7..... *R. Gaertneri*

2. Length of flowers 4–7.5 cm., the segments ascending to wide-spreading: joints mostly 3–6 cm. long, each margin with 3–6 crenations..... *R. Gaertneri* var. *Gaertneri*

2. Length of flowers to 3.5 cm., the segments scarcely spreading: joints smaller, each margin with about 3 crenations..... *R. Gaertneri* var. *Tiburtii*

† **Rhipsalidopsis Gaertneri,** (Regel) Moran, trans. nov.

Epiphyllum Russellianum var. *Gaertneri*, Regel, in Gartenfl. xxxiii, 323, t. 1172 (1884).

Epiphyllum Gaertneri, W. Rob. in Garden, xxxv, 376 (1889).

Rhipsalidopsis Gaertneri, (Regel) Moran, var. **Gaertneri.**

Epiphyllum Russellianum var. *Gaertneri*, Regel, in Gartenfl. xxxiii, 323, t. 1172 (1884).

Epiphyllum Gaertneri, W. Rob. in Garden, xxxv, 376 (April 27, 1889).

Epiphyllum Makoyanum, W. Wats. in Gard. & For. ii, 243 (May 22, 1889).

Phyllocactus Gaertneri, Schum. in Rümpl. & Schum. Sukkulenten, 147, f. 80 (1892).

Epiphyllum coccineum, Hort. ex Capelle & Rüst, in Monatsschr. f. Kakteenk. vii, 99 (1897), *nomen.*

Epiphyllum Gaertneri var. *coccineum*, Capelle & Rüst, op. cit. 101.

Epiphyllum Gaertneri var. *Makoyanum*, Capelle & Rüst, l. c.

Phyllocactus Gaertneri var. *Makoyanus*, Schum. in Gesamtbeschr. Kakt. 221 (1897).

* Described for *R. Gaertneri;* unknown in *R. rosea.*

Schlumbergera Gaertneri, Britt. & Rose, in Contr. U. S. Nat. Herb. xvi, 260 (1913).

Rhipsalis Gaertneri, Vaupel, in Engler & Prantl, Nat. Pflanzenfam. Ed. 2, xxi, 619 (1925).

Epiphyllopsis Gaertneri, Berger, Kakteen, 97, 341 (1929), *nomen provis.*; Backeberg & Knuth, Kaktus-ABC, 158 (1935).

Epiphyllopsis Gaertneri var. *Makoyana*, Backeberg & Knuth, op. cit. 159.

Schlumbergera Gaertneri var. *Makoyana*, Borg, Cacti, 358 (1937).

Much-branched erect subshrub with declined branches: lower joints (and sometimes upper ones) cereiform, ovoid to ellipsoid, 1–2 cm. long, .5–1 cm. thick, with 3–6 vertical or somewhat spiral ribs; leaves scale-like, triangular, fleshy, scarcely 1 mm. long; areoles small, with scanty wool; spines 6–20, divergent, setaceous, white to yellowish or brown, 3–4 or sometimes to 10 mm. long: upper joints mostly flat, elliptic-oblong to obovate or rarely cuneate, truncate or rounded, fleshy, dark green, mostly 3–6 cm. long, 1.5–3.5 cm. wide, the margins thin, sometimes reddish, each with 3–6 crenations, the midvein prominent only in dried specimens; leaves like those of the lower joints but slightly longer; areoles more woolly, the lateral to 1 mm. wide, with 3–12 short bristles, the apical several fused into an elongate somewhat sunken pseudo-areole, with bristles short or to 1.5 cm. long: flowers 1–5, pendent, diurnal, lasting about two weeks (?), regular, 4–7.5 cm. long, 5–7 cm. wide (depending partly on the degree of expansion), no fragrance mentioned; ovary obconic, naked, green or reddish, 5–12 mm. long, 7–8 mm. or more wide above, (4–) 5-angled, with as many rows of short-funicled ovules, the angles continued upward as triangular, obtuse, fleshy outer floral scales which intergrade with the perianth-segments but remain more or less distinct from the coalescent withering perianth; perianth-tube short, flaring; perianth-segments about 14–20, crimson to scarlet, ascending-outcurved to wide-spreading, linear-lanceolate, narrowly acute, mostly 3–4.5 cm. long, 6–8 mm. wide, the outer smaller; stamens numerous, inserted in one close series in the tube, inclined toward the center of the flower; filaments red, 1–2 cm. long; anthers yellow; style slender, exceeding the stamens, 1.5–3 cm. long, white to red; stigma-lobes 5–7, spreading, linear, white, about 1 cm. long: fruit obovoid, truncate-umbilicate, sharply (4–)5-angled, 12–15 mm. long, at first red, with scanty sweetish flesh, but long persistent, becoming dry and hard, eventually a lid falling away allowing the seeds to fall out; seeds about 7–10, compressed, semi-ovate (with one straight edge), acute at both ends, brown, smooth, shiny, just over 1 mm. long, about half as wide, with a prominent white hilum. Flowers in April and May in the northern hemisphere.

Near Joinville and Blumenau, State of Santa Catharina, Brazil; also reported from Minas Geraes.

This description is compiled from many sources, including Knebel (1951) for fruit and Capelle and Rüst (1897) and Berger (1926, fig. 24) for seeds. Since Knebel could scarcely have erred in his identification of

the plant or in his observations, the failure of earlier authors to report dehiscence of the fruit perhaps was due to their observations having been made at earlier stages. An obvious conclusion is that for plants of related genera some observer should allow fruit to remain indefinitely on the plant to make sure whether or not it is finally dry and dehiscent.

Although the epithet "Gaertneri" seems clearly to be the first applied to this plant in varietal status, there is some question whether "Gaertneri" or "Makoyanum" was first in specific status. Watson (1889) is usually given as the author for *Epiphyllum Makoyanum* and Schumann (1890) as the author for *E. Gaertneri*. Under this interpretation, the epithet "Makoyanum" should replace the established epithet "Gaertneri" for this plant. However, both names appeared in the horticultural literature several times in 1889, sometimes merely mentioned, sometimes incidentally described, sometimes also figured; and the decision as to where each was first validly published is somewhat arbitrary. Apparently the first mention was in The Garden for April 22, 1889. The brief description of *E. Makoyanum* is as complete as the later one by Watson, but it probably cannot be accepted as validly published because it is signed only with the unidentifiable initial "W" and because it says that *E. Gaertneri* "appears to be identical". A note by the editor, W. Robinson, mentions *E. Gaertneri* and also mentions the basonym: interpreted liberally for the sake of the established epithet, this may be considered to effect a new combination.

Carrière (1886) briefly described *Epiphyllum Gibsonii* in terms applying to this and no other known species. However, in a note later in the volume he said this name was an error for *E. Russellianum Gaertneri*.

Schumann (1897) used the epithet "Gaertneri" for the species and the epithet "Makoyanus" for a variety with long bristles at the apical areoles; in this he was followed by Berger (1929), Backeberg and Knuth (1935), and Borg (1937, 1951). Since, however, Regel's plate (1884) shows the type plant of *R. Gaertneri* with bristles perhaps 1 cm. long and since Watson made no mention of bristles for *E. Makoyanum*, Schumann's interpretation seems unjustified. According to Knebel (1951), this difference between the two supposed varieties does not hold. Although *E. Makoyanum* was a separate introduction from Brazil, Castle (1889), Watson (1889), and Pynaert (1889) all thought it nearly if not quite the same as *E. Gaertneri*. The only difference mentioned by any of these authors was an unspecified difference in the shade of the flowers.

Rhipsalidopsis Gaertneri was first named as a variety of what is here called *Schlumbergera Russelliana*. Britton and Rose (1913) placed it in Schlumbergera because of its short-jointed stem, regular flowers, and angled ovary. However, it differs from Schlumbergera in several respects: some joints, especially the lower ones, may be short, 3–6-angled, and bristly; the flowers remain open only during the day; the perianth-segments

are scarcely united at the base and commonly are more spreading; the stamens are all inserted at the base of the perianth, with no inner staminal tube; the stigma-lobes are free and spreading; and the fruit is dry and apically circumscissile. Clearly this species does not fit well in Schlumbergera. Weber (1894–1898), Schumann (1903), and Vaupel (1925, 1926) recognized few genera of cacti, but they all agreed in placing it in a different genus from *Schlumbergera truncata* and *S. Russelliana*. Berger (1929) provisionally proposed for it a separate genus Epiphyllopsis. Backeberg and Knuth (1935) accepted the genus, crediting it to Berger. By their indirect reference to Berger's characterization, they may be considered to have validated the name.

Vaupel (1925) placed this species with *Rhipsalidopsis rosea* as his Gruppe Gaertnerianæ of Rhipsalis. Kimnach (1951) remarked that it has the same flowering period as *R. rosea* and, though smaller, resembles it in stem and flowers. In characters by which it differs from Schlumbergera it resembles Rhipsalidopsis (except that the fruit and seeds of *R. rosea* are unknown). Apparently this is where the species belongs.

According to Schumann (1902), *R. Gaertneri* appears not to hybridize with *Schlumbergera truncata*. Of course the possibility of this cross is not excluded, and a cross with *S. Russelliana* is perhaps less unlikely. On the other hand, *R. Gaertneri* does hybridize with *R. rosea*. Werdermann (1939) described the hybrid as *Rhipsalis* (or × *Rhipsaphyllopsis*) × *Graeseri*. This becomes † **Rhipsalidopsis** × **Graeseri,** (Werd.) Moran, trans. nov.

† **Rhipsalidopsis Gaertneri** var. **Tiburtii,** (Backeberg & Voll) Moran, trans. nov.

Epiphyllopsis Gaertneri var. *Tiburtii*, Backeberg & Voll, in Arq. Jard. Bot. Rio Janeiro, ix, 149, t. 1, f. 1 (1950).

Smaller in all parts: margins of joints about 3-crenate; areolar hairs [spines?] few, brown, 5–7 mm. long: flowers to 3.5 cm. long, the perianth-segments scarcely spreading: fruit subglobose, weakly 5-ribbed, 1 cm. thick; seeds spindle-shaped, brown.

State of Paraná, Brazil.

HATIORA, Britt. & Rose, in Bailey, Stand. Cyclo. Hort. 1432 (1915).

Hariota, DC. Mém. Cact. 23 (1834), not Adans. (1763).

Rhipsalis, sect. [?] *Hariota*, Endl. Gen. Pl. 945 (1840).

Rhipsalis, Gruppe *Salicornioides*, Vaupel, in Engler & Prantl, Nat. Pflanzenf. Ed. 2, xxi, 619 (1925).

Rhipsalis and relatives give a typical example of the difficulty of generic delimitation in the family. Rhipsalis is a large and diverse genus apparently not easily divisible into distinct taxa. The diversity of Rhipsalis makes it difficult to find absolute distinctions between Rhipsalis and closely

related taxa, so that these taxa have often been included. As a result, the genus has become even more diverse and difficult to define exclusively, and in some treatments it has come to include plants which, though agreeing in some diagnostic characters, may be only superficially similar and not closely related. The question is which of the borderline taxa to keep separate. The gross morphology of various of these plants was ably discussed by Buxbaum (1942).

In Hatiora, as delimited by Britton and Rose, the stem is divided into cylindric to clavate determinate joints of about equal length; the areoles are unequally distributed, mostly toward the upper end of each joint; flowers and joints are produced only from the crowded apical areoles; the flowers are essentially like those of Rhipsalis, though the petals are erect and yellow whereas in Rhipsalis they are more often spreading and white. In Rhipsalis, as defined by Britton and Rose (but with *R. clavata* removed), the stems may be terete with short terminal joints borne on elongate stems, or they may be flattened and of more or less uniform short joints; but apparently they are never of uniform terete joints. Furthermore, the areoles are not crowded toward the apex. Branching is lateral in some species of Rhipsalis but terminal in many, and flowers are usually lateral but may be terminal in some of the species with unequal joints.

Some authors, such as Weber (1898), separated Hariota (as a section) chiefly on the basis of the terminal flowers. Thus defined, it includes *R. cereuscula* and *R. cribrata*, in which the branches range from long to short, with more or less evenly distributed areoles. Although these species may be related to Hatiora, the division seems more natural if they remain in Rhipsalis. Furthermore, the definition of Hatiora by Britton and Rose, giving the flower color as yellow, excludes *R. clavata*, which otherwise agrees with Hatiora. This becomes † **Hatiora clavata,** (A. Weber) Moran, comb. nov. (*Rhipsalis clavata*, A. Weber, in Rev. Hort. lxiv, 429, 1892).

A new problem is raised by the recently discovered *Rhipsalis epiphylloides*, Porto & Werd. This species was placed by Porto and Castellanos (1941) in Hariota and by Backeberg (1942) in a separate genus, Pseudozygocactus. The joints, like those of Rhipsalidopsis and Schlumbergera, are short and flat, with marginal areoles; and as in these genera and in Hatiora flowers and new joints come from crowded terminal areoles. The flowers, like those of Hatiora and Rhipsalis, are small, with few stamens and few and free perianth-segments. The ovary is angled as in Rhipsalidopsis and in two Schlumbergeras rather than terete as in Hatiora and in most species of Rhipsalis; and it becomes umbilicate as in Rhipsalidopsis and Schlumbergera. The fruit is described as pulpy as in Hatiora, rather than dry and dehiscent as in *R. Gaertneri;* and the seed shape resembles that of Hatiora rather than that of *R. Gaertneri*. However, until the fruit and seeds of *R. rosea* are known, a final comparison with Rhipsali-

dopsis is impossible. It may be that other morphological evidence, such as that from pollen-grains or seed structure, or cytological or genetic evidence will suggest a closer relationship of this species to Rhipsalidopsis or to Hatiora. On the basis of present evidence it seems closer to Hatiora but still intermediate between them.

On the basis of gross characters, there is thus a series from *Schlumbergera truncata* to Rhipsalis. The extremes are so different that no one has ever placed them in the same genus; and, although close relationship seems probable, it cannot be considered as definitely established. The recognition of Schlumbergera, Rhipsalidopsis, Pseudozygocactus, and Hatiora, all as genera separate from Rhipsalis, seems to be carrying the subdivision too far. Yet it is a question how they can be combined. Everyone probably will agree that Schlumbergera should be in a different genus from Rhipsalis. Since the sharpest break in the series apparently comes between Schlumbergera and Rhipsalidopsis, the combination of any of the other genera with Schlumbergera would weaken its distinction from the remaining genera. Therefore, Schlumbergera seems best maintained in its present circumscription (unless Epiphyllanthus is also included).

If the fruit of *Rhipsalidopsis Gaertneri* is correctly described and if *R. rosea* proves to have similar fruit and seeds, then Rhipsalidopsis will seem a distinct and natural genus. However, if the fruit or seeds of *R. rosea* are more like those of other species, the problem will be as difficult as ever.

With the characters of Rhipsalidopsis still incompletely known, morphological gaps separating Rhipsalidopsis, Pseudozygocactus, and Hatiora from one another and from Rhipsalis are perhaps equally small. Therefore, there seems no good reason for combining any two of them unless all are included in Rhipsalis. In the future, some sound basis may be found for combining Pseudozygocactus either with Rhipsalidopsis or with Hariota. But for the present it appears that either all three genera should be maintained or they all should be included in Rhipsalis. Since *Rhipsalidopsis Gaertneri* seems too different from Rhipsalis to be placed there, Rhipsalidopsis, Pseudozygocactus, and Hatiora all are tentatively accepted as genera.

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ARTICLE 16.
A RECLASSIFICATION OF THE GENUS IRIS.

By G. H. M. Lawrence

The latest classification of the genus Iris is that by Diels (1930) based on the monograph by Dykes (1913). It has been recognized that, in addition to perpetuating some nomenclatural errors and creating others, these classifications are unrealistic to the extent that the authors placed the species in only two categories subordinate to the rank of genus (i.e., in section and subsection). Evidence from both cytogenetic and taxonomic studies indicates that, if these species are accepted as comprising a single genus (and evidence is accumulating that they may represent more than one genus), then their relationships are shown best if they are classified among four infrageneric categories (subgenus, section, subsection, and series).

In arriving at this reclassification, every effort has been made to determine the nomenclatural status and circumscription of all infrageneric groups—a study not known to have been made heretofore. This study has shown the invalidity of many of the infrageneric names when used in more than one category and the illegitimacy of others. This is especially true of subgeneric and sectional names in Iris, as shown by Table I.

The major subdivisions of the genus according to this reclassification are as follows:

I. Subgen. Iris (the rhizomatous species), page 352.
  1. Sect. Pogiris, Tausch (the bearded species), page 352.
    a. Subsect. Pogoniris, (Spach) Benth., page 353.
    b. Subsect. Hexapogon, Benth., page 354.
    c. Subsect. Oncocyclus, (Siemss.) Benth., page 355.
    d. Subsect. Pseudoregelia, (Dykes) Lawr., page 356.
  2. Sect. Spathula, Tausch emend. Lawr. (the non-bearded species), page 356.
    a. Subsect. Pardanthopsis, (Hance), Lawr., page 357.
    b. Subsect. Fœtidissima, Diels, page 357.
    c. Subsect. Apogon, Benth. (composed of 15 Series), page 358.
    d. Subsect. Evansia, Benth., page 363.
II. Subgen. Nepalensis, (Dykes) Lawr., page 363.
III. Subgen. Xiphium, (Mill.) Spach, page 363.
  1. Sect. Xiphion, Tausch, page 364.
  2. Sect. Reticulata, Dykes, page 364.
IV. Subgen. Scorpiris, Spach, page 365.
V. Subgen. Gynandriris, (Parl.) Lawr., page 366.

In preparing this treatment, all cited literature has been consulted. The designation of each type species has been more or less arbitrary and is subject to revision on receipt of information (not now known to me) that other species already have been designated as nomenclatural types. The paper is in no way a revision or monograph of the genus. The assignment of binomials to each taxon is based on opinions of other workers and no study was made to determine specific and infraspecific relationships or to determine whether, in fact, each binomial does represent a species.

The extensive synonymy has been prepared only after careful study of each infrageneric name and of its circumscription by its author. As a result of this study it is apparent that application of the rule of priority and the "homonym rule" (Art. 74, ICBN [1]) will invalidate the use of one or more well known infrageneric names if either currently accepted or earlier classifications are used. The present classification displaces two existing names used by Dykes and by Diels. The significance of this situation is illustrated by Table I.

In this reclassification I have placed all the rhizomatous species in one subgenus (Iris), those with the rootstock a bundle of fleshy roots in a second subgenus (Nepalensis), those species with bulbs or corms lacking roots during the dormant period in a third (Xiphium), and those with bulbs or corms possessing fleshy roots during the dormant period in the fourth subgenus (Scorpiris). The greater number of species belong in the subgenus Iris, and this I have subdivided into two sections: the section Pogiris containing all the bearded species, and the section Spathula containing all the non-bearded species. The bearded species are distributed among four subsections: those with multicellular beards and non-arillate seeds (the so-called German iris types) in subsection Pogoniris; the remainder, all with unicellular beards and usually with arillate seeds, include those known popularly as the regelia, oncocyclus, and pseudoregelia irises and comprise the three remaining subsections.

The beardless irises of the section Spathula are reclassified as belonging to one of four subsections: *I. dichotoma* and *I. fœtidissima* are the sole members of two subsections—Pardanthopsis and Fœtidissima, respectively; the crested irises are placed in the subsection Evansia; and all the rest of the beardless species are treated as distributed among 15 series within the subsection Apogon.

The nomenclature of some of the major taxa requires explanation. Some, at first glance, may object to repetition of the name Iris when used both as a generic and subgeneric name. The Rules require this that there

[1] The abbreviation ICBN is used to designate the International Code of Botanical Nomenclature (1952), successor to Ed. 3 of the Rules of International Botanical Nomenclature (1935).

TABLE 1. Valid names of infrageneric groups in Iris in the categories of subgenus, section, and subsection (excl. taxa subordinate to subsect. Apogon).

Sectional name adopted by Dykes	Valid name as a subgenus	Valid name as a section	Valid name as a subsection	Category and name adopted in reclassification
Pogoniris	Iris	Pogiris, Tausch	Pogoniris, (Spach) Benth.	Subsect. Pogoniris
Regelia	Psammiris, Spach	Hexapogon, (Bunge) Baker	Hexapogon, Benth.	Subsect. Hexapogon
Oncocyclus	Susiana, Spach	Oncocyclus, (Siemss.) Baker	Oncocyclus, (Siemss.) Benth.	Subsect. Oncocyclus
Pseudoregelia	Pseudoevansia, Baker	Pseudoregelia, Dykes	Pseudoregelia, (Dykes) Lawr.	Subsect. Pseudoregelia
Pardanthopsis	Pardanthopsis, (Hance) Baker	Pardanthopsis, Hance	Pardanthopsis, (Hance) Lawr.	Subsect. Pardanthopsis
[not recognized]	Spathula, (Tausch) Spach *pro parte*	Spathula, Tausch *pro parte*	Fœtidissima, Diels	Subsect. Fœtidissima
Apogon	Limniris, Tausch ex Spach	Limniris, Tausch	Apogon, Benth.	Subsect. Apogon [subdivided into 15 Series]
Evansia	Crossiris, Spach	Lophiris, Tausch	Evansia, Benth.	Subsect. Evansia
Nepalensis	Nepalensis, (Dykes) Lawr.	Nepalensis, Dykes	[none]	Subgen. Nepalensis
Xiphium	Xiphium, (Mill.) Spach	Xiphion, Tausch	[none]	Subgen. Xiphium
[not recognized]	Hermodactyloides, Spach	Xiphion, Tausch	[none]	Sect. Xiphion
Reticulata	[none]	Reticulata, Dykes	[none]	Sect. Reticulata
Juno	Scorpiris, Spach	Juno, (Tratt.) Benth.	[none]	Subgen. Scorpiris
Gynandriris	Gynandriris, (Parl.) Lawr.	Gynandriris, (Parl.) Benth.	[none]	Subgen. Gynandriris

may be no question as to which of two or more subgenera contains the type of the genus. On the grounds of inappropriateness, the non-taxonomist may object to the names Iris, Pogiris, and Pogoniris to separate (1) rhizomatous from non-rhizomatous species (as subgenus Iris from subgenus Xiphium), (2) bearded from non-bearded (as section Pogiris from section Spathula) and (3) multicellular from unicellular bearded species (as subsection Pogoniris from subsection Oncocyclus). The rules of botanical nomenclature are specific in stating that (Art. 72, ICBN) a name "must not be rejected, merely because it is inappropriate, or disagreeable, or because another is preferable or better known, or because it has lost its original meaning." The principle of priority is responsible for the use of these names and no legal basis is known to exist for substitution of more appropriate or more descriptive names.

The name Regelia is currently well known for those arillate species having beards on all six perianth-segments. The name was first used by Sir Michael Foster (1889) who did not assign it to a particular category nor did he describe it. Baker (1892) named the section Regelia, but without description. The name was validated for the first time by Dykes in 1913. A few species of this group were segregated as the subgenus Psammiris by Spach (1846), others as the subgenus Hexapogon by Alefeld (1863). Baker, in 1878, restricted Alefeld's Hexapogon to include (as a section) the regelias, and separated from it the Oncocyclus irises. Bentham (1882) accepted the name Hexapogon for these so-called "Regelia" species but in the category of subsection, as did Pax in Engler and Prantl (1888). From this it is clear that the name Hexapogon antedates Regelia in the category of subgenus, of section, and of subsection. The name Regelia has no botanical standing and must be relegated to synonymy. These irises as a group, however, may very properly be referred to in the vernacular as Regelia irises.

It may be contended that there are sound taxonomic reasons for the elevation of the beardless rhizomatous iris, known as the apogons, to the rank of subgenus. However, to do so would make it necessary to take up an older and long-forgotten name in that category, Xiridion, (Tausch) Spach. There are equally valid taxonomic reasons to elevate sections Pardanthopsis, Fœtidissima and Evansia to the same level, a procedure that would leave the name of the first unchanged, would change the second to Spathula, and would require the change of the last to the older subgeneric name of Crossiris, Spach (see Table I).

There are valid reasons also for treating the subsection Pogoniris as composed of three subordinate taxa: dwarfs, talls, and intermediates. This was done by Randolph (1948). In the classification that follows, the subsection is treated as composed of two series: Pumilæ and Elatæ. In this connection, it is recognized that there is a group of horticultural sig-

nificance, composed of hybrids and clones, that break down the botanical distinction between these two series but there seems to be no morphological basis by which these Pogoniris species can be separated into three purely taxonomic groups.

The hybrid intermediates of Pogoniris comprise both the natural hybrids (*I. germanica*, *I. florentina*, *I. serbicans*, *I. aphylla*, *I. Kochii*, et al.) and those experimental hybrids having a chromosome complement of $2n=44$. In addition there are other hybrids, as the progeny of *I. pumila* × tall bearded having $2n=40$, and hybrids of dwarfs with $2n=24$ (the *I. mellita* complex) or $2n=48$ with the diploid and tetraploid tall bearded taxa. Consideration must be given also to hybrids between *I. Chamæiris* dwarfs ($2n = 40$) and diploid tall bearded. Provision is made for the classification and nomenclature of these hybrids in the recently proposed International Code of Nomenclature for Cultivated Plants (London 1952). By this provision, the progeny of each cross is given a collective fancy name, as "Mellita hybrids" and individuals treated conventionally as clones. It is not correct to attempt to intercalate this mélange as a discrete botanical taxon at a taxonomic level collateral with the Series Elatæ and Pumilæ.

The disposition of species assigned to all of the infrageneric groups requires monographic study from the world viewpoint. This paper does not pretend to be monographic. In this connection, cytogenetic evidence has indicated a number of probable changes in the status of plants now accorded specific rank, some are known to be of hybrid origin (probably natural hybrids) and several to many may be found to merit only infraspecific rank. An earlier draft of this paper was read and criticised by L. F. Randolph, well known geneticist at Cornell University and specialist in Iris breeding research, and much of the present paper has been gone over with me by R. C. Foster of the Gray Herbarium, Harvard University. To each I express my appreciation for their many constructive criticisms and helpful suggestions.

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37–38, 143–144, 226, 323–324, 517–518, 583–584, 614–615, 647–648, 701–702, 740–741, 774–775, 806 (1876). — Baker, J. G. *Systema Iridacearum*, in Journ. Linn. Soc. Lond. Bot. xvi, 136–147 (1877). — Bentham, G. in Bentham, G. & Hooker, J. D. *Genera Plantarum*, iii, 686–687 (1882). — Boissier, E. *Flora orientalis*, v, 117–138 (1884). — Pax, F. *Iris* in Engler & Prantl, Die natürliche Pflanzenfamilien ii (5), 145–146 (1888). — Baker, J. G. *Handbook of Irideae*, 1–47 (1892). — Dalla Torre, C. G. & Harms, H. *Genera Siphonogamarum*, p. 80 (1900). — Dykes, W. R. *The genus Iris* (1913). — Diels, L. *Iris* in Engler & Prantl, Die natürliche Pflanzenfamilien, Aufl. 2, 15a, 500–505 (1930).

Type species: *Iris germanica*, L.[2]

KEY TO THE SUBGENERA, SECTIONS, AND SUBSECTIONS OF THE GENUS IRIS[3]

1. Rootstock a conspicuous rhizome.....Subgen. I. IRIS
   2. Falls (outer perianth-segms.) bearded with unicellular or multicellular hairs.....Sect. 1. POGIRIS
      3. Beard of multicellular clavate hairs: seed lacking an aril. Subsect. 1a. POGONIRIS
      3. Beard of unicellular hairs: seed bearing a usually cream-colored aril.
         4. Outer and inner perianth-segments (standards and falls) bearded: rhizomes spreading by stolons.....Subsect. 1b. HEXAPOGON
         4. Outer perianth-segments (falls) only bearded: rhizomes not stoloniferous.
            5. Beard widely scattered over haft (claw) of fall: rhizome not gnarled.....Subsect. 1c. ONCOCYCLUS
            5. Beard along median line of fall: rhizome compact and gnarled.....Subsect. 1d. PSEUDOREGELIA
   2. Falls not bearded but sometimes crested.....Sect. 2. SPATHULA
      6. Stems branching dichotomously and seemingly racemose to paniculate: seed with small terminal aril.....Subsect. 2a. PARDANTHOPSIS
      6. Stems not branching dichotomously: seeds lacking an aril.
         7. Falls smooth and lacking a crest.
            8. Seeds vermillion-red, persisting in the capsule-valves after dehiscence.....Subsect. 2b. FŒTIDISSIMA
            8. Seeds colored otherwise, not persistent within dehisced capsule-valves.....Subsect. 2c. APOGON
         7. Falls with a cockscomb-like crest.....Subsect. 2d. EVANSIA

[2] The plant known in the wild is represented by one phenotype but two genotypes: one genotype of restricted distribution and uncommon has $2n = 48$ chromosomes, the other of general distribution has $2n = 44$ chromosomes. The second is presumed to be a true-breeding natural hybrid. It is the form cultivated as *I. germanica*. It is not known which genotype is the nomenclatural type, represented by the type specimen in the Linnæan herbarium. It has been suggested that, because of its hybrid origin and because it is not known which of the two genotypes is represented by the Linnæan specimen of *I. germanica*, the specimen of *I. variegata*, L. should be designated as the type of the genus and of those infrageneric taxa where *I. germanica* is now designated. *Iris germanica*, L. already has been designated by M. L. Greene [Species Lectotypicæ, in International Rules of Botanical Nomenclature, Ed. 3, 1935] as the lectotype of the genus. The case for substitution of *I. variegata* is being documented by me and submitted for review and disposition by the International Committee on Botanical Nomenclature, before the change in name of the type of the genus is effected.

[3] The 15 series of Subsect. Apogon are keyed separately in the text under the heading of that subsection (page 358).

1. Rootstock a bulb or the roots fleshy.
   9. The rootstock a bundle of fleshy roots arising from a minute rhizome terminated by a nipple-like growing point.....Subgen. II. NEPALENSIS
   9. The rootstock a bulb or corm.
      10. Rootstock a bulb.
         11. Bulbs lacking roots during dormant period: inner perianth-segments (standards) large, erect.....Subgen. III. XIPHIUM
            12. The bulb naked.....Sect. 1. XIPHION
            12. The bulb covered by a fibrous tunic.....Sect. 2. RETICULATA
         11. Bulbs with fleshy roots remaining attached during dormant period: inner perianth-segments (standards) small, often minute, spreading or deflexed.....Subgen. IV. SCORPIRIS
      10. Rootstock a corm.....Subgen. V. GYNANDRIRIS

I. **Iris** subgen. **Iris.**

Iris subgen. *Pogoniris*, Spach, in Ann. Sci. Nat. ser. 3, v, 103 (1846); and Spach, in Hist. Nat. Veg. xiii, 48–68 (1846); Klatt, in Bot. Zeit. xxx, 515 (1872); Baker, in Journ. Linn. Soc. Lond. Bot. xvi, 143 (1877).

Spach credited the epithet Pogoniris to Tausch, but the latter is not the author of this, but of the epithet Pogiris in the category of section (q.v.).

The subgenus Iris is so named in conformance with Art. 32 of ICBN (1952) which states, "The subgenus containing the type species of a generic name must bear that name unaltered." [See also Art. 73 (5).] The provisional type species of the genus Iris is *I. germanica*, L., a species that belongs in this subgenus (see page 351 for discussion). The subgenus Iris is here circumscribed to include all species of Iris characterized by a fleshy rhizomatous rootstock, sometimes compact and gnarled, the roots not fleshy; the perianth bearded, crested or beardless.

Heretofore this subgenus has usually been treated as composed of five sections and a large number of subsections. However, genetical and morphological considerations indicate that the biological situation is better reflected by treating these rhizomatous species as comprising 2 sections (Pogiris for the bearded irises and Spathula for the non-bearded), with each subdivided into 4 subsections and the species of one of these (Subsect. Apogon) distributed among 15 series. For key to sections and subsections, see page 351.

Type species: *I. germanica*, L.

1. **Iris** sect. **Pogiris,** Tausch, Hort. Canalius, 1 (1823) and Tausch in Schultes, Additamentum Mantissum, ii, 369 (1824), emend. Lawr.

Iris sect. *Euiris*, Benth. in Benth. & Hook. Gen. Pl. iii, 686 (1882).

Iris subgen. *Euiris*, (Benth.) Boiss. Fl. Orient. v, 118 (1884), not Alef. 1863.

The circumscription of sect. Euiris, Benth. is that of sect. Pogiris, Tausch emend. Lawr. Although sect. Euiris contains the type of the older subgen. Euiris, Alef. (1863), Bentham and Hooker did not cite Alefeld's name and there is no reason to believe that they based their section on it. For this reason, subgen. Euiris, (Benth. & Hook.) Boiss. was a superfluous name, antedated by Alefeld's name and by subgen. Pogoniris, Spach.

Pogiris was established by Tausch and adopted by Schultes for the multicellular-bearded non-arillate irises, represented by *Iris germanica*, L.

It is here emended to include all of the bearded species, irrespective of whether the beard is multicellular or unicellular or the seed arillate or non-arillate.

The section is emended to contain the subsections Pogoniris (the so-called "German" irises), Hexapogon (the so-called Regelia irises), Oncocyclus, and Pseudoregelia.

Type: *Iris germanica*, L.

1a. **Iris** subsect. **Pogoniris,** (Spach) Benth. in Benth. & Hook. Gen. Pl. iii, 687 (1882); Pax in Engler & Prantl, Nat. Pflanzenfam. ii (5), 145 (1888).

Iris subgen. *Pogoniris*, Spach, in Ann. Sci. Nat. ser. 3, v, 103 (1846); and Hist. Nat. Veg. xiii, 48–68 (1846); Klatt, in Bot. Zeit. xxx, 515 (1872); Baker, in Journ. Linn. Soc. Lond. Bot. xvi, 143 (1877).

Iris subgen. *Euiris*, Alef. in Bot. Zeit. xxi, 296 (1863), not Boiss. 1884, nor Klatt, in Linnaea, xxxiii, 591–604 (1866).
This name, subgen. Euiris, was for the taxon designated Pogoniris by Spach (1846), hence was superfluous when published and is an illegitimate name.

Iris sect. *Pogoniris*, Baker, in Gard. Chron. ser. 3, vi, 647 (1876); Dykes, Gen. Iris, p. 135 (1913) (excl. *I. flavissima*, Pallas).

Iris subgen. *Eupogoniris*, Randolph, in Bull. Amer. Iris Soc. cix, 3 (1948).

Type: *Iris germanica*, L.

The so-called pogoniris species have not formally been divided heretofore into subordinate categories. Baker (1876) keyed the species into "groups" designated by the binomial of an included species and later (1878) into the five "Stirpes": *Pumilæ*, *Bifloræ*, *Variegatæ*, *Germanicæ*, and *Pallidæ*. The informal category of "stirpes" has no botanical standing and the names are *nomina nuda*. Dykes (1913) grouped them informally by vernacular or binary names. Diels (1930) keyed 30 species but recognized no subdivisions of the section. Randolph (1948) divided the pogoniris species into vernacularly named sections. None was formally described [i.e., none was given a Latin name nor properly described in conformance with the Rules] and hence has no nomenclatural standing.

From a study of the cytology and systematics of the better known species, it is clear that subdivisions or groupings do exist and the following are proposed, largely on the basis of studies by Randolph (1948).

† **Iris** series **Pumilæ**, Lawr. ser. nov.

Herbæ humiles, raro usque ad 3 dm. altæ, acaules vel breviter caulescentes et tunc sine ramis, foliis caules floriferos æquantibus vel superantibus.

Plants dwarf, rarely reaching one foot in height, acaulescent or nearly so and unbranched when caulescent, the leaves as long as flowering stems or longer.

Type: *Iris pumila*, L.

Included species:

?*I. biflora*, L.
?*I. Bloudowii*, Bunge
I. Chamæiris, Bert.
I. Griffithii, Baker
I. mandschurica, Maxim.
I. mellita, Janka
I. Potaninii, Maxim.
I. pseudopumila, Tineo
I. pumila, L.
I. Reichenbachii, Heuff.
I. scariosa, Willd. ex Link
I. subbiflora, Brot.
I. Tigridia, Bunge

† **Iris** series **Elatæ**, Lawr. ser. nov.

Herbæ mediocres vel proceræ, ultra 3 dm. altæ, valde caulescentes et ramosæ, foliis raro caules floriferos superantibus.

Plants medium to tall, exceeding one foot in height, strongly caulescent and branched, the leaves rarely overtopping or exceeding the flowering stems.

Type: *Iris germanica*, L.

Included species:

I. Albertii, Regel
I. albicans, Lange (nat. hybrid)
I. amæna, DC.
I. aphylla, L. (nat. hybrid)
I. Biliottii, M. Foster
I. Cengialtii, Ambrosi
I. cypriana, Baker & Foster
I. flavescens, DC.
I. germanica, L. (nat. hybrid)
I. imbricata, Lindl.
I. Junonia, Schott & Kotschy
I. kashmiriana, Baker (hybrid?)
I. Kochii, Kerner
I. lurida, Soland.
I. mesopotamica, Dykes
I. pallida, Lam.
I. trojana, Kerner
I. variegata, L.

1b. **Iris** subsect. **Hexapogon**, Benth. in Benth. & Hook. Gen. Pl. iii, 687 (1882); Pax in Engler & Prantl, Nat. Pflanzenfam. ii (5), 145 (1888).

Iris subgen. *Psammiris*, Spach, in Ann. Sci. Nat. ser. 3, v, 110 (1846), and Hist. Nat. Veg. xiii, 69–70 (1846) (based on *I. arenaria*, Waldst. & Kit., a syn. of *I. flavissima*, Pall.).

Iris subgen. *Hexapogon*, Bunge ex Alef., *pro parte*, in Bot. Zeit. xxi, 296 (1863); Baker, in Journ. Linn. Soc. Lond. Bot. xvi, 147 (1877).

Iris sect. *Hexapogon*, (Bunge) Baker, in Gard. Chron. ser. 3, v, 787–788 (1876); Boiss. Fl. Orient. v, 119 (1884).

Iris subgen. *Regelia*, M. Foster ex Baker, Handb. Irideæ, 1, 20 (1892), *nomen nudum*.

Iris sect. *Regelia*, Dykes, Gen. Iris, 123–124 (1913); Diels, in Engler & Prantl, Nat. Pflanzenfam. Aufl. 2, 15a, 503 (1930).

Iris subgen. *Pogoniris*, Randolph, in Bull. Amer. Iris Soc. cix, 4 (1948), quoad sect. *Regelia*, Dykes, 1913; not Spach 1846, nor Baker 1876.

Type: *Iris falcifolia*, Bunge.

Included species:

I. darwasica, Regel
I. falcifolia, Bunge
I. flavissima, Pall.
(incl. *I. arenaria*, Waldst. & Kit.).
I. Hoogiana, Dykes
I. Korolkowii, Regel
I. stolonifera, Maxim.

The taxon Hexapogon was founded by Spach as a subgenus on the basis of the barbellate claws of the inner and outer perianth-segments and in it he placed the species *I. arenaria*, Waldst. & Kit. Later Alefeld took it up (as subgenus Hexapogon) and included within it *I. falcifolia* and *I. susiana* (the latter since transferred to subsection Oncocyclus).

In 1889 Sir Michael Foster recognized this subsection as distinct and, without evidencing knowledge of Baker's prior sectional name Hexapogon, said (Journ. Hort. xi, 144), "since we owe knowledge of them very largely to the venerable Director of the Botanic Gardens at St. Petersburg, I have proposed to call them the Regelia group." Foster neither described the group nor assigned it to a botanical category. Baker reversed himself in 1892 when he adopted the name Regelia for this same taxon but in the rank of subgenus, credited it to Foster, and said of it only, "connects Oncocyclus and Pogoniris." Even here the name was a *nomen nudum*. The first valid publication of the name was by Dykes (1913). The well known name "regelia" is illegitimate (superfluous when published), was long a *nomen nudum* (i.e., prior to 1913) and may not be used in the genus for the rank of subgenus, section or subsection.

Iris flavissima is transferred from section Pogiris on the basis of its stoloniferous rhizomes, subapically dehiscent capsules, and pyriform seeds with a white aril. It is probable that *I. Bloudowii* and *I. mandschurica* also belong here. The transfer of *I. flavissima*, Pall. (together with *I. arenaria*, Waldst. & Kit., which probably is no more than a subspecies of it) requires also the transfer of the name Iris subgenus Psammiris, Spach, as a synonym of subsection Hexapogon. Spach's name antedates subgenus Hexapogon, Bunge (1863), and would have to be taken up by anyone treating the taxon as a subgenus.

Species of subsection Hexapogon are distinguished from those of Oncocyclus by the spathe-valves subtending 2 to 4 flowers, the beard usually along a narrow median line, and the spathes more or less keeled. No distinctions of rhizome or seed morphology are known to separate the two sections.

1c. **Iris** subsect. **Oncocyclus,** (Siemss.) Benth. in Benth. & Hook. Gen. Pl. iii, 687 (1882).

Oncocyclus, Siemss. in Bot. Zeit. iv, 706–707 (1846).
Iris subgen. *Susiana*, Spach, in Ann. Sci. Nat. ser. 3, v, 110 (1846), and Hist. Nat. Veg. xiii, 70–71 (1846) (based on *I. Susiana*, L.).
Iris subgen. *Oncocyclus*, (Siemss.) Alef. in Bot. Zeit. xxi, 296 (1863); Baker, in Journ. Linn. Soc. Lond. Bot. xvi, 142 (1877).
Iris sect. *Oncocyclus*, (Siemss.) Baker, in Gard. Chron. ser. 3, v, 788 (1876).
Iris subgen. *Pogoniris*, Randolph, in Bull. Amer. Iris Soc. cix, 4 (1948) quoad *Oncocyclus* Siemss.; not Spach 1846, nor Baker 1876.

Type: *Iris paradoxa*, Steven.

Included species:

I. acutiloba, Mey.
I. atrofusca, Baker
I. atropurpurea, Baker
I. Barnumæ, M. Foster & Baker
I. Bismarckiana, Dammann
I. Gatesii, M. Foster
I. hauranensis, Dinsm.
I. Helenæ, Barbey (*I. Mariæ*, Barbey)
I. iberica, Hoffm.
I. jordana, Dinsm.
I. Lortetii, Barbey
I. Meda, Stapf
I. paradoxa, Steven
I. Saari, Schott [*I. Sari*, Auth.]
I. sofarana, M. Foster
I. susiana, L.

The subsection Oncocyclus was founded in 1882 by Bentham who based his concept and names on Siemssen's genus of the same name. The designation of the type species is an arbitrary selection and this name is the first of three listed by Siemssen (*O. paradoxa*, *O. ibericus*, *O. acutilobus*), who curiously enough made no mention of the older Linnæan species, *Iris susiana*. The latter species was first transferred here from the Hexapogons by Baker in 1876. Anyone who would consider this taxon to be a subgenus of Iris, must then adopt for it the oldest name in that category, that of subgenus Susiana, Spach.

Like the Hexapogons, species of this section have arillate seeds characterized by a creamy-white collar, and pink-skinned rhizomes. They differ from them in having unicellular hairs of the beard, widespread over the median zone of the claw, the one-flowered stems, and the outer leaves usually strongly falcate.

† 1d. **Iris** subsect. **Pseudoregelia,** (Dykes) Lawr. stat. nov.

Iris sect. *Pseudoregelia*, Dykes, Gen. Iris, 129 (1913).
Iris subgen. *Pseudoevansia*, Baker, Handb. Irideæ, 2 (1892), *nomen nudum*.

Type: *Iris kumaonensis*, Wall.

Species included:

I. goniocarpa, Baker
I. Hookeriana, M. Foster
I. kumaonensis, Wall.
I. sikkimensis, Dykes

The name of this subsection was changed deliberately by Dykes from Baker's subgenus of the same circumscription, on the grounds that the plants were more closely allied to those of his section "Regelia" (i.e., subsection Hexapogon) than to the crested iris of subsection Evansia. Dykes rejected, on apparently sound morphological grounds, three species from this section that were placed by Baker in "Pseudoevansia." Wallich's *I. kumaonensis* (the oldest of the four accepted binomials) is arbitrarily designated above as the nomenclatural type for the section.

Species of the subsection Pseudoregelia are characterized by the small weakly arillate seed, gnarled compact rhizomes, the absence of stolons, a broad capsule with an attenuate apex not splitting at maturity (dehiscence is subapical), the subtruncate standards mottled with two shades of purple.

2. **Iris** sect. **Spathula,** Tausch, emend. Lawr.

Iris sect. *Spathula*, Tausch, Hort. Canalius, 1 (1823); Tausch in Schultes, Additamentum Mantissum, ii, 370 (1824).
Ioniris, Klatt, in Bot. Zeit. xxx, 502 (1872).

This section, established by Tausch to provide sectional recognition for the one species, *I. fœtidissima*, L. (see page 347 for characterization), and the oldest name in this category for the taxon, is here emended to include all the rhizomatous irises whose perianth-parts are beardless, together with those beardless species whose perianth-parts are crested.

It is subdivided into 4 subsections: Paradanthopsis (*I. dichotoma* the only species), Fœtidissima (*I. fœtidissima* the only species), Apogon, and Evansia. The beardless species are treated here as a single taxon collateral with the rhizomatous bearded iris, and the two sections compose the subgenus Iris.

Type: *Iris sibirica*, L.

† 2a. **Iris** subsect. **Pardanthopsis,** (Hance) Lawr. stat. nov.

Pardanthus dichotomus, (Pall.) Ledeb. Fl. Ross. iv, 106 (1853).
Evansia dichotoma, (Pall.) Decne. in Bull. Soc. Bot. Fr. xx, 302 (1873).
Iris sect. *Pardanthopsis*, Hance, in Journ. Bot. xiii, 105 (1875); Diels, in Engler & Prantl, Nat. Pflanzenfam. Aufl. 2, 15a, 502 (1930).
Iris subgen. *Pardanthopsis*, (Hance) Baker, Handb. Irideæ, 1 (1892), *pro parte*.

Type, and only species: *Iris dichotoma*, Pall.

The subsection Pardanthopsis is distinguished from others of this subgenus by the several-times-dichotomously branched multi-flowered dichasial inflorescence (not racemose as described by Baker and Dykes), by the seed with a large pinkish terminal aril, and by the perianth tightly contorted after anthesis. The relationship of the plant has been interpreted variously although the presence of standards and falls and the petaloid style-branches place it unequivocably in Iris. Its mode of branching and foliage are markedly like those of Belamcanda, and Ledebour placed the two under the generic name Pardanthus; while Decaisne considered *I. dichotoma* to be composed of two species that he placed in the segregate genus Evansia.

2b. **Iris** subsect. **Fœtidissima,** Diels, in Engler & Prantl, Nat. Pflanzenfam. Aufl. 2, 15a, 502 (1930).

Iris sect. *Spathula*, Tausch, Hort. Canalius, 1 (1823), *pro parte*.
Iris subgen. *Spathula*, (Tausch) Spach, in Ann. Sci. Nat. ser. 3, v, 97 (1846), and Hist. Nat. Veg. xiii, 31–32 (1846), *pro parte*.
Spathula, (Tausch) Fourr. in Ann. Soc. Linn. Lyon, n. ser. xvii, 163 (1869).

Type, and only species: *Iris fœtidissima*, L.

This species has been retained for nearly a century with the apogons, presumably because of its beardless perianth. However, it differs from them in a number of significant respects. Dykes has stated that no one has been able to cross it with any of the apogons. Its dull brownish-purple flowers are insignificant-appearing and its most distinctive character lies in the fruit and seed. The globose seeds are vermillion in color and remain attached by their raphe to the capsule for several months after dehiscence —much as do the seeds of Belamcanda. No other iris is known to have this seed character. The species is as distinct from other apogons as is *Iris dichotoma*, the monotype of subsection Pardanthopsis, and if the latter is a natural and distinct taxon, so also is subsection Fœtidissima.

2c. **Iris** subsect. **Apogon,** Benth. in Benth. & Hook. Gen. Pl. iii, 687 (1882).

Iris sect. *Limniris*, Tausch, Hort. Canalius, 1 (1823); Tausch in Schultes, Additamentum Mantissum, ii, 369 (1824).

Iris subgen. *Limniris*, (Tausch) Spach, in Ann. Sci. Nat. ser. 3, v, 99 (1846), and Hist. Nat. Veg. xiii, 36–37 (1846), *quoad typus*.

Limniris, (Tausch) Fuss, Fl. Transsylv. 636 (1866).

Iris sect. *Apogon*, Baker, in Gard. Chron. ser. 3, vi, 143–144 (1876); Boiss. Fl. Orient. v, 119 (1884); Dykes, Gen. Iris, 18–19 (1913), *nomen illegit.*

Iris subgen. *Apogon*, Baker, in Journ. Linn. Soc. Lond. Bot. xvi, 136–141 (1877), *nomen illegit.*

Type: *Iris sibirica*, L.

This subsection contains all the species of beardless rhizomatous iris, commonly known as apogons, except *I. dichotoma* (subsection Pardanthopsis), *I. fœtidissima* (subsection Fœtidissima), and subsection Evansia.

The subsectional name Apogon was made by Bentham as a new name for the taxon in this category. It was not a transfer of Baker's illegitimate name from the categories of subgenus or section. It should be noted from the above synonymy that if this taxon is placed in any of the infrageneric categories above that of subsection, the name Apogon is antedated by other names and may not be used. (See Table 1, page 348)

Spach (1846) distributed the species here included in Apogon among the subgenera Xyridion, Graminiris, Eremiris, Joniris, Limniris, and Phaeiris, but had no taxon equivalent to Baker's Apogon.

The subsection Apogon contains more species than all others combined. Baker (1876) divided the taxon first into 8 unnamed groups and later (1892) abandoned all subdivisions, separating only the linear-leaved from the ensiform-leaved. Dykes (1913) divided it into 15 "groups", without formal designation of category, arranged in the sequence later adopted by Diels but identified by an anglicized name or by the binary epithet of an included species. Diels (1930) adopted Dykes' subdivisions, Latinized their epithets, and treated them formally as subsections. The disposition of binomials in the series of this treatment (arranged alphabetically) except as otherwise noted, is taken directly from that by Diels and by Dykes.

KEY TO SERIES OF SUBSECTION APOGON [4]

1. Capsule trigonal with 3 ribs, or subterete with no conspicuous ribs (valves sometimes grooved).
   2. Seed with a white aril-like persistent raphe (shrivelling on drying), globose or pyriform.
      3. Pedicel present (0.6–10 cm. long): spathes somewhat inflated and enveloping perianth-tube.....Series (6) *Ruthenicæ*
      3. Pedicel absent or obsolete: spathes usually divergent and exposing the perianth-tube.....Series (15) *Vernæ*

[4] This artificial key is strictly provisional and is suggestive of distinctions between the taxa. Many of the species have not been examined by me and characters for them have been taken from the literature.

2. Seeds lacking an aril-like appendage, usually flattened on one or more sides, often D-shaped.
   4. Perianth-tube 10–20 cm. long; styles with gold-dust-like processes; blade of falls abruptly expanded from haft into a nearly orbicular limb.. ..... Series (7) *Unguiculares*
   4. Perianth-tube 1–7.5 cm. long (rarely more); styles and falls not as above.
      5. Stigma with a projecting triangular tongue: seeds D-shaped or cubical.
         6. Rhizomes stout, brown..... Series (1) *Sibiricæ*
         6. Rhizomes slender, reddish or pink as are also the more or less persistent leaf-bases..... Series (3) *Californicæ*
      5. Stigma lacking a triangular tongue, often bilobed: seeds variable.
         7. Stem-leaves reduced to short inflated linear-acuminate bracts, basally tinged or flushed red or pink..... Series (3) *Californicæ*
         7. Stems with 1 or more foliaceous leaves.
            8. Rhizome annulate (ringed) with stiff bristles.. Series (4) *Syriacæ*
            8. Rhizome annulate but not bristly.
               9. Standards reduced to bristles or scale-like..... ..... Series (14) *Tripetalæ*
               9. Standards distinctly petaloid.
                  10. Leaves 1.2 cm. wide or more: anthers usually white or yellow (blue in *I. versicolor*): rhizome stout..... Series (9) *Lævigatæ*
                  10. Leaves mostly 0.6 cm. wide or less (rarely to 0.9 mm. wide): anthers blue or purple: rhizome often slender and wiry..... Series (2) *Tenuifoliæ* Series (5) *Chinenses*

1. Capsule hexagonal or each of the 3 angles 2-ribbed; stigma 2-toothed.
   11. Haft of falls expanding abruptly into an orbicular limb.
      12. Seed compressed, testa loose and parchment-like: stems stout..... ..... Series (8) *Spuriæ*
      12. Seed pyriform, testa close-fitting: stems slender, wiry...Series (10) *Prismaticæ*
   11. Haft of falls expanding gradually into the limb, or else the limb elliptic to oblong.
      13. Capsule cylindrical or subglobose ..... Series (13) *Longipetalæ*
      13. Capsule somewhat fusiform, tapering basally and apically.
         14. Ovary trigonal or ribbed; seeds with corky coat... Series (11) *Hexagonæ*
         14. Ovary 6-grooved; seeds glossy or shiny..... Series (12) *Ensatæ*

† (1) **Iris** series **Sibiricæ,** (Diels) Lawr. stat. nov.[5]

Iris sect. *Limniris*, Tausch *pro parte*, Hort. Canalius, 1 (1823); and Tausch in Schultes, Additamentum Mantissum, ii, 369 (1824).

Iris subgen. *Limniris*, (Tausch) Spach *pro parte*, in Ann. Sci. Nat. ser. 3, v, 99 (1846), and Hist. Nat. Veg. xiii, 36–37 (1846).

Iris subsect. *Sibiricæ*, Diels, in Engler & Prantl, Nat. Pflanzenfam. Aufl. 2, 15a, 501 (1930).

Type: *Iris sibirica*, L.

[5] Dykes placed *I. prismatica*, Pursh, in this subsection (Diels did not mention the species) but R. C. Foster (1938) accepted, on the basis of cytotaxonomic evidence, J. K. Small's earlier segregation of it as representing the monotypic (subsection?) *Prismaticæ*.

Species included:

I. Bulleyana, Dykes
I. chrysographes, Dykes
I. Clarkei, Baker
I. Delavayi, Mich.
I. Forrestii, Dykes
I. orientalis, Thunb.
I. sibirica, L.
I. Wilsonii, C. H. Wright

† (2) **Iris** series **Tenuifoliæ,** (Diels) Lawr. stat. nov.

Iris subsect. *Tenuifoliæ*, Diels, in Engler & Prantl, Nat. Pflanzenfam. Aufl. 2, 15a, 501 (1930).

Type and only species: *Iris tenuifolia*, Pall.

† (3) **Iris** series **Californicæ,** (Diels) Lawr. stat. nov.

Iris subsect. *Californicæ*, Diels, in Engler & Prantl, Nat. Pflanzenfam. Aufl. 2, 15a, 501 (1930); R. C. Foster, in Contr. Gray Herb. cxix, 13–14 (1937).

Species included:[6]

I. bracteata, Wats.
I. chrysophylla, Howell
I. Douglasiana, Herb.
I. Fernaldii, R. C. Foster
I. Hartwegii, Baker
I. innominata, L. F. Henderson
I. macrosiphon, Torr.
I. Munzii, R. C. Foster
I. pinetorum, Eastw.
I. Purdyi, Eastw.
I. tenax, Dougl.
I. tenuis, Wats.
I. tenuissima, Dykes
I. Thompsonii, R. C. Foster

† (4) **Iris** series **Syriacæ,** (Diels) Lawr. stat. nov.

Iris subsect. *Syriacæ*, Diels, in Engler & Prantl, Nat. Pflanzenfam. Aufl. 2, 15a, 502 (1930).

Type, and only species: *Iris Grant-Duffii*, Baker.

(Syns. incl. *I. Aschersonii*, M. Foster, *I. melanosticta*, Bornm., *I. masia*, Dykes).

† (5) **Iris** series **Chinenses,** (Diels) Lawr. stat. nov.

Iris subsect. *Chinenses*, Diels, in Engler & Prantl, Nat. Pflanzenfam. Aufl. 2, 15a, 502 (1930).

Type: *I. minuta*, Franch. & Sav.

Species included:

I. Grijsii, Maxim.
I. Henryi, Baker
I. koreana, Nakai
I. minuta, Franch. & Sav.
I. Rossii, Baker

† (6) **Iris** series **Ruthenicæ,** (Diels) Lawr. stat. nov.

Iris subgen. *Joniris*, Spach, in Ann. Sci. Nat. ser. 3, v, 98 (1846), and Hist. Nat. Veg. xiii, 35–36 (1846).

Xiphion subgen. *Joniris*, (Spach) Alef. in Bot. Zeit. xxi, 297 (1863), *pro parte*.

Joniris, (Spach) Klatt, in Bot. Zeit. xxx, 502 (1872).

Iris subsect. *Ruthenicæ*, Diels, in Engler & Prantl, Nat. Pflanzenfam., Aufl. 2, 15a, 502 (1930).

Type, and only species: *Iris ruthenica*, Ker-Gawl.

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[6] Binomial listing based on Foster, l. c.

† (7) **Iris** series **Unguiculares,** (Diels) Lawr. stat. nov.

Iris subsect. *Unguiculares*, Diels, in Engler & Prantl, Nat. Pflanzenfam. Aufl. 2, 15a, 502 (1930).

Type, and only species: *Iris unguicularis*, Poir.

† (8) **Iris** series **Spuriæ,** (Diels) Lawr. stat. nov.

Iris sect. *Xyridion*, Tausch, Hort. Canalius, 1 (1823); and Tausch in Schultes, Additamentum Mantissum, ii, 370 (1824).

Iris subgen. *Xyridion*, Tausch ex Spach, in Ann. Sci. Nat. ser. 3, v, 94 (1846), and Hist. Nat. Veg. xiii, 23–29 (1846).

Iris subgen. *Graminiris*, Spach, in Ann. Sci. Nat. ser. 3, v, 96 (1846), and Hist. Nat. Veg. xiii, 29–31 (1846).

Xiphion subgen. *Euxiphion*, Alef. in Bot. Zeit. xxi, 297 (1863), *pro parte.*

Xiphion, (Tausch) Fourr., in Ann. Soc. Linn. Lyon, n. ser. xvii, 163 (1869), *pro parte;* Klatt, in Bot. Zeit. xxx, 499 (1872).

Xyridion, (Tausch) Fourr. in Ann. Soc. Linn. Lyon, n. ser. xvii, 163 (1869).

Iris subsect. *Spuriæ*, Diels, in Engler & Prantl, Nat. Pflanzenfam. Aufl. 2, 15a, 502 (1930).

Type: *Iris spuria*, L.

Species included:

I. graminea, L.
I. humilis, Bieb.
I. Kerneriana, Aschers.
I. Sintenisii, Janka
I. spuria, L.[7]

† (9) **Iris** series **Lævigatæ,** (Diels) Lawr. stat. nov.

Iris subgen. *Limniris*, Tausch ex Spach, in Ann. Sci. Nat. ser. 3, v, 99 (1846), *pro parte*, and Hist. Nat. Veg. xiii, 36–46 (1846).

Iris subgen. *Lanugophorus*, Klatt, in Bot. Zeit. xxx, 513–514 (1872), *pro parte.* (*Limniris*, Tausch, op. cit. *pro parte* and *Phæiris*, Tausch, op. cit.).

Iris sect. *Virginicæ*, Waller, in Ohio Journ. Sci. xxxi, 32–33 (1931), *nomen nudum.*

Iris XI. *Versicolores*, Small, Man. Southeast. Fl. 837 (1933).

Iris subsect. *Lævigatæ*, Diels, in Engler & Prantl, Nat. Pflanzenfam. Aufl. 2, 15a, 402 (1930).

This series, established by Dykes (1913) and nomenclaturally validated by Diels to include the species listed below, has been restricted inferentially by Waller (1931) and by Foster (1938) to contain only the Eurasian species. Both of these later workers accept the transfer of *I. virginica* and *I. versicolor* to a new section "Virginicæ". Unfortunately this latter section was not described by Waller and the inadequate description by Foster (1938) lacks Latin diagnosis. In the apparent absence of characters necessary for the separation of these two species as a

[7] Dykes treated the following as:

(1) subspecies (possibly only vars.?)
I. orientalis, Mill. (*I. ochroleuca*, L.), *I. Monnieri*, DC., *I. crocea*, Jacquem. ex Baker (*I. aurea*, Lindl.).

(2) varieties
I. maritima, Lam., *I. Reichenbachiana*, Klatt, *I. subbarbata*, Joo, *I. halophila*, Pall.

unit from the Eurasian species assigned by Dykes and Diels to the Lævigatæ, Waller's illegitimate name is not validated but is relegated to synonymy.

Type: *Iris lævigata*, Fisch.

Species included:

I. Kaempferi, Sieb.
I. lævigata, Fisch.
I. Pseudacorus, L.
I. versicolor, L.
I. virginica, L.

† (10) **Iris** series **Prismaticæ**, Lawr. stat. nov.

Iris X *Primaticæ*, Small, Man. Southeast. Fl. 336 (1933).
Iris subsect. *Prismaticæ*, R. C. Foster, in Contr. Gray Herb. cxix, 44 (1938), *nomen nudum*.

Type, and only species: *Iris prismatica*, Pursh.

† (11) **Iris** series **Hexagonæ**, (Diels) Lawr. stat. nov.

Iris subgen. *Phæiris*, Spach, in Ann. Sci. Nat. ser. 3, v, 102 (1846), and Hist. Nat. Veg. xiii, 46–48 (1846).
Iris subsect. *Hexagonæ*, Diels, in Engler & Prantl, Nat. Pflanzenfam. Aufl. 2, 15a, 502 (1930).
Iris I. *Fulvæ*, Small, Man. Southeast. Fl. 331 (1933).
Iris II. *Ecristatæ*, Small, op. cit. 332.
Iris III. *Bicristatæ*, Small, l. c.
Iris IV. *Unicristatæ*, Small, op. cit. 333.
Iris V. *Lancicristatæ*, Small, l. c.
Iris VI. *Tricristatæ*, Small, op. cit. 334.
Iris VII. *Coronicristatæ*, Small, op. cit. 335.
Iris VIII. *Radicristatæ*, Small, l. c.
Iris IX. *Hexagonæ*, Small, op. cit. 336.
Iris XIII. *Pseudacori*, Small, op. cit. 335.

Type: *Iris hexagona*, Walt.

Species included:

I. brevicaulis, Raf. (*I. foliosa*, Mackenzie & Bush)
I. fulva, Ker-Gawl.
I. hexagona, Walt.

† (12) **Iris** series **Ensatæ**, (Diels) Lawr. stat. nov.

Iris subgen. *Eremiris*, Spach, in Hist. Nat. Veg. xiii, 32–35 (1846).
Iris subsect. *Ensatæ*, Diels, in Engler & Prantl, Nat. Pflanzenfam. Aufl. 2, 15a, 502 (1930).

Type, and only species: *Iris ensata*, Thunb. (incl. *I Pallasii*, Fisch. ex Trev., *I. Doniana*, Spach).

† (13) **Iris** series **Longipetalæ**, (Diels) Lawr. stat. nov.

Iris subsect. *Longipetalæ*, Diels, in Engler & Prantl, Nat. Pflanzenfam. Aufl. 2, 15a, 502 (1930).

Type: *Iris longipetala*, Herb.

Species included:

I. longipetala, Herb.
I. missouriensis, Nutt.

† (14) **Iris** series **Tripetalæ,** (Diels) Lawr. stat. nov.

Iris subsect. *Tripetalæ*, Diels, in Engler & Prantl, Nat. Pflanzenfam. Aufl. 2, 15a, 502 (1930).

Iris XII. *Tripetalæ*, Small, Man. Southeast. Fl. 337 (1933).

Type: *Iris tridentata*, Pursh.

Species included:

I. setosa, Pall. *I. tridentata*, Pursh (*I. tripetala*, Walt. not L.f.)

† (15) **Iris** series **Vernæ,** (Diels) Lawr. stat. nov.

Iris subsect. *Vernæ*, Diels, in Engler & Prantl, Nat. Pflanzenfam. Aufl. 2, 15a, 502 (1930).

Type, and only species: *Iris verna*, L.

2d. **Iris** subsect. **Evansia,** Benth. in Benth. & Hook. Gen. Pl. iii, 687 (1882).

Evansia, Salisb. in Trans. Roy. Hort. Soc. i, 303 (1812), *nomen illegit.*

Iris subgen. *Crossiris*, Spach, in Ann. Sci. Nat. ser. 3, v, 110 (1846), and Hist. Nat. Veg. xiii, 71–72 (1846).
Based on *Evansia*, Salisb. and *Iris fimbriata*, Vent., a synonym of *I. japonica*, Thunb.

Iris sect. *Lophiris*, Tausch, Hort. Canalius, 1 (1823); Tausch in Schultes, Additamentum Mantissum, ii, 369 (1824).
Based on *I. cristata*, Soland. and *I. chinensis*, Curt.

Xiphion subgen. *Evansia*, Alef. in Bot. Zeit. xxi, 297 (1863).
Based on *Evansia*, Salisb. and *Xiphion fimbriatum* (Thunb.) Alef.

Iris subgen. *Cristairis*, Klatt, in Bot. Zeit. xxx, 517 (1872), *pro parte.*
Based on *Iris cristata*, Soland.

Iris subgen. *Evansia*, (Alef.) Baker, in Journ. Linn. Soc. Lond. Bot. xvi, 143 (1877), and Handb. Irideæ, 2 (1892) (excl. *I. nepalensis*, D. Don).

Type: *Iris japonica*, Thunb.

Species included:

I. confusa, Sealy
I. cristata, Soland.
I. gracilipes, Gray
I. japonica, Thunb.
I. lacustris, Nutt.
I. Milesii, M. Foster
I. speculatrix, Hance
I. tectorum, Maxim.
I. Wattii, Baker

† II. **Iris** subgen. **Nepalensis,** (Dykes) Lawr. stat. nov.

Iris sect. *Nepalensis* Dykes, Gen. Iris, 16, 184 (1913); Diels, in Engler & Prantl, Nat. Pflanzenfam. Aufl. 2, 15a, 504 (1930).

Type, and only species: *Iris decora*, Wall. (*I. nepalensis*, D. Don, *I. Collettii*, Hook. f.).

III. **Iris** subgen. **Xiphium,** (Mill.) Spach, in Ann. Sci. Nat. ser. 3, v, 92 (1846), and Hist. Nat. Veg. xiii, 18–23 (1846).

Xiphium, Mill. Gard. Dict. Ed. 8 (1768).

Iris subgen. *Xiphion*, Boiss. Fl. Orient. iii, 118 (1884), *pro parte* (excl. sect. *Gynandriris*).

Type: *Iris Xiphium*, L.

Miller (Gard. Dict. Ed. 8, 1768) gave the two spellings "Xiphion or Xiphium" at the head of his treatment of the genus, but consistently used

the spelling "Xiphium" throughout the text. It was his prerogative to select the spelling for the name and it is clear that he chose "Xiphium." Jackson in Index Kewensis arbitrarily changed it to "Xiphion." The Rules allow either ending but state that the original spelling must be retained. In establishing the subgenus, Spach adopted Miller's spelling 'Xiphium,' crediting it to Miller and indicating its pre-Linnæan usage (at the generic level) by Tournefort. Spach based his subgenus on *I. Xiphium*, L.

The subgenus Xiphium contains the bulbous irises, as the so-called Spanish iris, the Dutch iris. There is no evidence of genetic compatibility between any species of this subgenus and those of subgenus Iris and records of efforts at hybridization in this direction give only negative results.

1. **Iris** sect. **Xiphion,** Tausch, Hort. Canalius, 1 (1823); and Tausch in Schultes, Additamentum Mantissum, ii, 370 (1824).

Based on *I. Xiphium*, Mill.

Diaphne, Salisb. in Trans. Roy. Hort. Soc. i, 305 (1812).
Established as a monotypic genus, *D. stylosa*, Salisb. and based on "*Iris juncea*, Desf." which is *I. juncea*, Poir.
Iris subgen. *Hermodactyloides*, Spach, in Ann. Sci. Nat. ser. 3, v, 91 (1846), and Hist. Nat. Veg. xiii, 16 (1846).
Xiphion, Parl. sect. *Euxiphium*, Alef. *pro parte* (ex sect. Juno), in Bot. Zeit. xxi, 297 (1863); emend. Baker, in Gard. Chron. n. ser. v, 526 (1876).
Iris sect. *Diaphne*, (Salisb.) Benth. in Benth. & Hook. Gen. Pl. iii, 687 (1882); Pax, in Engler & Prantl, Nat. Pflanzenfam. ii (5), 146 (1888).
Iris sect. *Euxiphion*, Boiss. Fl. Orient. iii, 118 (1884).
Iris subgen. *Xiphion*, [Mill.] Baker, Handb. Irideæ, 2 (1892).
Iris sect. *Xiphium*, (Mill.) Dykes, Gen. Iris, 210–211 (1913); Diels, in Engler & Prantl, Nat. Pflanzenfam. Aufl. 2, 15a, 504 (1930).

Despite the apparent nomenclatural incongruity of subgenus Xiphium containing section Xiphion, the Rules allow no exception to adoption of the oldest legitimate epithet for these categories. The oldest sectional name known to me is Tausch's Xiphion. In this section, Tausch included three species: *I. Xiphium*, *I. Sisyrinchium* and *I. tuberosa*.

Type: *I. Xiphium*, L.

Species included:

I. Boissieri, Henriq.
I. filifolia, Boiss.
I. Fontanesii, Godr.
I. juncea, Poir.
I. tingitana, Boiss. & Reut.
I. xiphioides, Ehrh.
I. Xiphium, L.

2. **Iris** sect. **Reticulata,** Dykes, Gen. Iris, 220 (1913); Diels in Engler & Prantl, Nat. Pflanzenfam. Aufl. 2, 15a, 505 (1930).

Type: *Iris reticulata*, Bieb.

Species included:

I. Bakeriana, M. Foster
I. Danfordiæ, (Baker) Boiss.
I. Histrio, Reichb. f.
I. histrioides, (G. F. Wilson) S. Arnott
I. Kolpakowskiana, Regel
I. reticulata, Bieb.
I. Vartanii, M. Foster
?*I. Winkleri*, Reg.

IV. **Iris** subgen. **Scorpiris,** Spach, in Ann. Sci. Nat. ser. 3, v, 91 (1846).

Thelysia, Salisb. in Trans. Roy. Hort. Soc. i, 303 (1812).
Juno, Tratt. ex Roem. & Schult. Systema, i, 471 (1817).
Costia, Willk. in Bot. Zeit. xviii, 131 (1860).
Coresantha, Alef. in Bot. Zeit. xxi, 298 (1863).
Based on *Iris persica*, L.
Xiphion sect. *Juno*, (Tratt.) Baker, in Gard. Chron. ser. 3, v, 526 (1876).
Iris sect. *Juno*, (Tratt.) Benth. in Benth. & Hook. Gen. Pl. iii, 687 (1882); Boiss. Fl. Orient. iii, 121 (1884); Pax, in Engler & Prantl, Nat. Pflanzenfam. ii (5), 146 (1888); Dykes, Gen. Iris, 187 (1913).
Iris subgen. *Juno*, (Tratt.) Baker, Handb. Irideæ, 2 (1892).

Spach based his subgenus Scorpiris on *Iris persica*, L., including with it *I. scorpioides*, Desf. [a synonym of *I. alata*, Poir.] and *I. caucasica*, Hoffm. His ample description of the subgenus leaves no doubt as to its circumscription. The adoption of the name Scorpiris in place of the currently better known name Juno is made mandatory by the rule of priority. However, regardless of the Latin name applied to the taxon, the plants included will continue to be known to many as the Juno irises.

The evidence supporting recognition of this taxon as a subgenus is considerable. Taxonomists long have accepted the validity of the morphological criteria here used to separate it from allied taxa: the bulbs with fleshy roots persisting on them during the often extended dormant period, the inner perianth-segments small and often spreading or deflexed, and the stigmatic lobes very markedly petaloid. In addition to these morphological characters, even greater significance may be placed in the cytogenetic differences. There is some compatibility between some species within the taxon but none between them and those of other subgenera of Iris. Furthermore, there is a difference of chromosome numbers (insofar as is known) for the species of Xiphium as contrasted with that for the species of Scorpiris. The series found in the former is represented by the numbers 18, 22, 24, and 26; that for the latter by the numbers 32, 34, and 42. The species here included in Scorpiris seem to form a taxon as discrete from Xiphium and other subgenera as are the subgenera Nepalensis, Pardanthopsis, and Gynandriris from one another and from those of the bulbous species.

Type: *Iris persica*, L.
Species included:

I. Aitchisonii, (Baker) Boiss.
I. alata, Poir. (*I. scorpioides*. Desf.)
I. albomarginata, R. Foster (*I. cærulea*, B. Fedtsch. not Spach)
I. Aucheri, (Baker) Sealy (*I. sindjarensis*, Boiss.)
I. bucharica, M. Foster
I. caucasica, Hoffm.
I. drepanophylla, Aitch. & Baker
I. Fosteriana, Aitch. & Baker
I. linifolia, O. Fedtsch.
I. orchioides, Carr.
I. palestina, Boiss.
I. persica, L.
I. Rosenbachiana, Regel
I. Stocksii, Boiss.
I. Tubergeniana, M. Foster
I. warleyensis, M. Foster
I. Willmottiana, M. Foster

† V. **Iris** subgenus **Gynandriris,** (Parl.) Lawr. stat. nov.

Gynandriris, Parl. Nuovo gen. e spec. Monocot. 49 (1854).

Iris sect. *Gynandriris*, (Parl.) Benth. in Benth. & Hook. Gen. Pl. iii, 687 (1882).

Type, and only species: *Iris Sisyrinchium*, L.

FINDING-LIST OF IRIS NAMES

The following list of names applied to Iris taxa of all infrageneric categories cited in this paper is provided as an aid to determining their disposition in the foregoing reclassification. Taxa of a given classificatory level are grouped together alphabetically (i.e., names as genera, subgenera, sections, subsections, and series). Names of taxa accepted in this paper as taxonomically valid are set in **bold face,** names of synonyms in *italics*, and names used for purpose of cross-reference in roman type.

Coresantha, Alef. = Iris subgen. Scorpiris.
Costia, Willk. = Iris subgen. Scorpiris.
Diaphne, Salisb. = Iris sect. Xiphion.
Evansia, Salisb. = Iris subsect. Evansia.
Gynandriris, Parl. = Iris subgen. Gynandriris.
Ioniris, Klatt = Iris sect. Spathula.
Joniris, Klatt = Iris ser. Ruthenicæ.
Juno, Tratt. = Iris subgen. Scorpiris.
Limniris, Fuss = Iris subsect. Apogon.
Oncocyclus, Siemss. = Iris subsect. Oncocyclus.
Spathula, Fourr. = Iris subsect. Fœtidissima *pro parte.*
Thelysia, Salisb. = Iris subgen. Scorpiris.
Xiphion, Parl. = Iris sect. Xiphion.
Xiphion, (Tausch) Fourr. = Iris ser. Spuriæ *pro parte.*
Xiphium, Mill. = Iris subgen. Xiphium.
Xyridion, (Tausch) Fourr = Iris ser. Spuriæ.

Iris subgen. *Apogon*, Baker = Iris subsect. Apogon.
Iris subgen. *Cristairis*, Klatt = Iris subsect. Evansia *pro parte.*
Iris subgen. *Crossiris*, Spach = Iris subsect. Evansia.
Iris subgen. *Eremiris*, Spach = Iris ser. Ensatæ.
Iris subgen. *Euiris*, Alef. not Boiss. nor Klatt = Iris subsect. Pogoniris.
Iris subgen. *Euiris* (Benth.) Boiss. = Iris sect. Pogiris.
Iris subgen. *Eupogoniris*, Randolph = Iris subsect. Pogoniris.
Iris subgen. *Evansia*, (Alef.) Baker = Iris subsect. Evansia.
Iris subgen. *Graminiris*, Spach = Iris ser. Spuriæ.
Iris subgen. **Gynandriris,** (Parl.) Lawr. (page 366).
Iris subgen. *Hermodactyloides*, Spach = Iris sect. Xiphion.
Iris subgen. *Hexapogon*, Bunge ex Alef. = Iris subsect. Hexapogon.
Iris subgen. **Iris** (page 352).
Iris subgen. *Joniris*, Spach = Iris ser. Ruthenicæ.
Iris subgen. *Juno*, (Tratt.) Baker = Iris subgen. Scorpiris.
Iris subgen. *Lanugophorus*, Klatt = Iris ser. Lævigatæ *pro parte.*
Iris subgen. *Limniris*, (Tausch) Spach = Iris ser. Sibiricæ *pro parte.*
Iris subgen. *Limniris* (Tausch) Spach = Iris subsect. Apogon *pro parte.*
Iris subgen. *Limniris*, Tausch ex Spach = Iris ser. Lævigatæ *pro parte.*
Iris subgen. **Nepalensis,** (Dykes) Lawr. (page 363).
Iris subgen. *Oncocyclus* (Siemss.) Alef. = Iris subsect. Oncocyclus.
Iris subgen. *Pardanthopsis*, (Hance) Baker = Iris subsect. Pardanthopsis *pro parte.*
Iris subgen. *Phaeiris*, Spach = Iris ser. Hexagonæ.
Iris subgen. *Pogoniris*, Randolph = Iris subsect. Hexapogon *pro parte.*
Iris subgen. *Pogoniris* Randolph = Iris subsect. Oncocyclus *pro parte.*
Iris subgen. *Pogoniris* Spach = Iris subsect. Pogoniris.

Iris subgen. *Psammiris*, Spach = Iris subsect. Hexapogon.
Iris subgen. *Pseudoevansia*, Baker = Iris subsect. Pseudoregelia.
Iris subgen. *Regelia*, Foster ex Baker = Iris subsect. Hexapogon.
Iris subgen. **Scorpiris,** Spach (page 365).
Iris subgen. *Spathula*, (Tausch) Spach = Iris subsect. Fœtidissima *pro parte.*
Iris subgen. *Susiana*, Spach = Iris subsect. Oncocyclus.
Iris subgen. *Xiphion*, Boiss. = Iris subgen. Xiphium *pro parte.*
Iris subgen. **Xiphium,** (Mill.) Spach (page 363).
Iris subgen. *Xyridion*, Tausch ex Spach = Iris ser. Spuriæ.
Xiphion subgen. *Evansia*, Alef. = Iris subsect. Evansia.
Xiphion subgen. *Joniris*, (Spach) Alef. = Iris ser. Ruthenicæ.

Iris sect. *Apogon*, Baker = Iris subsect. Apogon.
Iris sect. *Diaphne*, (Salisb.) Benth. = Iris sect. Xiphion.
Iris sect. *Euiris*, Benth. = Iris sect. Pogiris.
Iris sect. *Euxiphion*, Boiss. = Iris sect. Xiphion.
Iris sect. *Gynandriris*, Benth. = Iris subgen. Gynandriris.
Iris sect. *Hexapogon*, (Bunge) Baker = Iris subsect. Hexapogon.
Iris sect. *Juno* (Tratt.) Benth. = Iris subgen. Scorpiris.
Iris sect. *Limniris*, Tausch = Iris ser. Sibiricæ *pro parte.*
Iris sect. *Limniris*, Tausch = Iris subsect. Apogon *pro parte.*
Iris sect. *Lophiris*, Tausch = Iris subsect. Evansia.
Iris sect. *Nepalensis*, Dykes = Iris subgen. Nepalensis.
Iris sect. *Oncocyclus*, (Siemss.) Baker = Iris subsect. Oncocylus.
Iris sect. *Pardanthopsis*, Hance = Iris subsect. Pardanthopsis.
Iris sect. **Pogiris,** Tausch emend. Lawr. (page 352).
Iris sect. *Pogoniris*, Baker = Iris subsect. Pogoniris.
Iris sect. *Pseudoregelia*, Dykes = Iris subsect. Pseudoregelia.
Iris sect. *Regelia*, Dykes = Iris subsect. Hexapogon.
Iris sect. **Reticulata,** Dykes (page 364).
Iris sect. *Spathula*, Tausch = Iris subsect. Fœtidissima *pro parte.*
Iris sect. **Spathula,** Tausch emend. Lawr. (page 356).
Iris sect. *Virginicæ*, Waller = Iris ser. Lævigatæ.
Iris sect. **Xiphion,** Tausch (page 364).
Iris sect. *Xiphium*, (Mill.) Dykes = Iris sect. Xiphion.
Iris sect. *Xyridion*, Tausch = Iris ser. Spuriæ.

Iris I. *Fulvæ*, Small = Iris ser. Hexagonæ.
Iris II. *Ecristatæ*, Small = Iris ser. Hexagonæ.
Iris III. *Bicristatæ*, Small = Iris ser. Hexagonæ.
Iris IV. *Unicristatæ*, Small = Iris ser. Hexagonæ.
Iris V. *Lancicristatæ*, Small = Iris ser. Hexagonæ.
Iris VI. *Tricristatæ*, Small = Iris ser. Hexagonæ.
Iris. VII. *Coronicristatæ*, Small = Iris ser. Hexagonæ.
Iris VIII. *Radicristatæ*, Small = Iris ser. Hexagonæ.
Iris IX. *Hexagonæ*, Small = Iris ser. Hexagonæ.
Iris X. *Prismaticæ*, Small = Iris ser. Prismaticæ.
Iris XI. *Versicolores*, Small = Iris ser. Lævigatæ.
Iris XII. *Tripetalæ*, Small = Iris ser. Tripetalæ.
Iris XIII. *Pseudacori*, Small = Iris ser. Hexagonæ.

Iris subsect. **Apogon,** Benth. (page 358).
Iris subsect. *Californicæ*, Diels = Iris ser. Californicæ.
Iris subsect. *Chinenses*, Diels = Iris ser. Chinenses.
Iris subsect. *Ensatæ*, Diels = Iris ser. Ensatæ.
Iris subsect. **Evansia,** Benth. (page 363).
Iris subsect. **Fœtidissima,** Diels (page 357).
Iris subsect. *Hexagonæ*, Diels = Iris ser. Hexagonæ.
Iris subsect. **Hexapogon,** Benth. (page 354).
Iris subsect. *Lævigatæ*, Diels = Iris ser. Lævigatæ.
Iris subsect. *Longipetalæ*, Diels = Iris ser. Longipetalæ.
Iris subsect. **Oncocylus,** (Siemss.) Benth. (page 355).
Iris subsect. **Pardanthopsis,** (Hance) Lawr. (page 357).
Iris subsect. **Pogoniris,** (Spach) Benth. (page 353).

Iris subsect. *Prismaticæ*, Foster = Iris ser. Prismaticæ.
Iris subsect. **Pseudoregelia,** (Dykes) Lawr. (page 356).
Iris subsect. *Ruthenicæ*, Diels = Iris ser. Ruthenicæ.
Iris subsect. *Sibiricæ*, Diels = Iris ser. Sibiricæ.
Iris subsect. *Spuriæ*, Diels = Iris ser. Spuriæ.
Iris subsect. *Syriacæ*, Diels = Iris ser. Syriacæ.
Iris subsect. *Tenuifoliæ*, Diels = Iris ser. Tenuifoliæ.
Iris subsect. *Tripetalæ*, Diels = Iris ser. Tripetalæ.
Iris subsect. *Unguiculares*, Diels = Iris ser. Unguiculares.
Iris subsect. *Vernæ*, Diels = Iris ser. Vernæ.

Iris ser. **Californicæ,** (Diels) Lawr. (page 360).
Iris ser. **Chinenses,** (Diels) Lawr. (page 360).
Iris ser. **Elatæ,** Lawr. (page 354).
Iris ser. **Ensatæ,** (Diels) Lawr. (page 362).
Iris ser. **Hexagonæ,** (Diels) Lawr. (page 362).
Iris ser. **Lævigatæ,** (Diels) Lawr. (page 361).
Iris ser. **Longipetalæ,** (Diels) Lawr. (page 362).
Iris ser. **Prismaticæ,** Lawr. (page 362).
Iris ser. **Pumilæ,** Lawr. (page 353).
Iris ser. **Ruthenicæ,** (Diels) Lawr. (page 360).
Iris ser. **Sibiricæ,** (Diels) Lawr. (page 359).
Iris ser. **Spuriæ,** (Diels) Lawr. (page 361).
Iris ser. **Syriacæ,** (Diels) Lawr. (page 360).
Iris ser. **Tenuifoliæ,** (Diels) Lawr. (page 360).
Iris ser. **Tripetalæ,** (Diels) Lawr. (page 363).
Iris ser. **Unguiculares,** (Diels) Lawr. (page 361).
Iris ser. **Vernæ,** (Diels) Lawr. (page 363).

I. acutiloba, Mey.: Iris subsect. Oncocyclus.
I. Aitchisonii, (Baker) Boiss.: Iris subgen. Scorpiris.
I. alata, Poir.: Iris subgen. Scorpiris.
I. Albertii, Regel: Iris ser. Elatæ.
I. albicans, Lange: Iris ser. Elatæ.
I. albomarginata, R. Foster: Iris subgen. Scorpiris.
I. amœna, DC.: Iris ser. Elatæ.
I. aphylla, L.: Iris ser. Elatæ.
I. Aschersonii, M. Foster: I. Grant-Duffii (ser. Syriacæ).
I. atrofusca, Baker: Iris subsect. Oncocyclus.
I. atropurpurea, Baker: Iris subsect. Oncocyclus.
I. Aucheri, (Baker) Sealy: Iris subgen. Scorpiris.
I. aurea, Lindl.: I. spuria ssp.? (ser. Spuriæ).
I. Bakeriana, M. Foster: Iris sect. Reticulata.
I. Barnumæ, M. Foster & Baker: Iris subsect. Oncocyclus.
I. biflora, L.: Iris ser. Pumilæ.
I. Biliottii, M. Foster: Iris ser. Elatæ.
I. Bismarckiana, Dammann: Iris subsect. Oncocyclus.
I. Bloudowii, Bunge: Iris ser. Pumilæ.
I. Boissieri, Henriq.: Iris sect. Xiphion.
I. bracteata, Wats.: Iris ser. Californicæ.
I. brevicaulis, Raf.: Iris ser. Hexagonæ.
I. bucharica, M. Foster: Iris subgen. Scorpiris.
I. Bulleyana, Dykes: Iris ser. Sibiricæ.
I. cærulea, B. Fedtsch: Iris albomarginata (subgen. Scorpiris).
I. caucasica, Hoffm.: Iris subgen. Scorpiris.
I. Cengialtii, Ambrosi: Iris ser. Elatæ.
I. Chamæiris, Bert.: Iris ser. Pumilæ.
I. chrysographes, Dykes: Iris ser. Sibiricæ.
I. chrysophylla, Howell: Iris ser. Californicæ.
I. Clarkei, Baker: Iris ser. Sibiricæ.
I. Collettii, Hook. f.: I. nepalensis (subgen. Nepalensis).
I. confusa, Sealy: Iris subsect. Evansia.
I. cristata, Soland.: Iris subsect. Evansia.
I. crocea, Jacquem. ex Baker: Iris spuria ssp.? (ser. Spuriæ).

I. cypriana, Baker & M. Foster: Iris ser. Elatæ.
I. Danfordiæ, Boiss.: Iris sect. Reticulata.
I. darwasica, Regel: Iris subsect. Hexapogon.
I. decora, Wall.: Iris subgen. Nepalensis.
I. Delavayi, Mich.: Iris ser. Sibiricæ.
I. dichotoma, Pall.: Iris subsect. Pardanthopsis.
I. Doniana, Spach: I. ensata (ser. Ensatæ).
I. Douglasiana, Herb.: Iris ser. Californicæ.
I. drepanophylla, Aitch. & Baker: Iris subgen. Scorpiris.
I. ensata, Thunb.: Iris ser. Ensatæ.
I. falcifolia, Bunge: Iris subsect. Hexapogon.
I. Fernaldii, R. Foster: Iris ser. Californicæ.
I. filifolia, Boiss.: Iris sect. Xiphion.
I. flavescens, DC.: Iris ser. Elatæ.
I. flavissima, Pall.: Iris subsect. Hexapogon.
I. fœtidissima, L.: Iris subsect. Fœtidissima.
I. foliosa, Mackenzie & Bush: I. brevicaulis (ser. Hexagonæ).
I. Fontanesii, Godr.: Iris sect. Xiphion.
I. Forrestii, Dykes: Iris ser. Sibiricæ.
I. Fosteriana, Aitch. & Baker: Iris subgen. Scorpiris.
I. fulva, Ker.-Gawl.: Iris ser. Hexagonæ.
I. Gatesii, M. Foster: Iris subsect. Oncocyclus.
I. germanica, L.: Iris ser. Elatæ.
I. goniocarpa, Baker: Iris subsect. Pseudoregelia.
I. gracilipes, Gray: Iris subsect. Evansia.
I. graminea, L.: Iris ser. Spuriæ.
I. Grant-Duffii, Baker: Iris ser. Syriacæ.
I. Griffithii, Baker: Iris ser. Pumilæ.
I. Grijsii, Maxim.: Iris ser. Chinenses.
I. halophila, Pall.: I. spuria var.? (ser. Spuriæ).
I. Hartwegii, Baker: Iris ser. Californicæ.
I. hauranensis, Dinsm.: Iris subsect. Oncocyclus.
I. Helenæ, Barbey: Iris subsect. Oncocyclus.
I. Henryi, Baker: Iris ser. Chinenses.
I. hexagona, Walt.: Iris ser. Hexagonæ.
I. Histrio, Reichb. f.: Iris sect. Reticulata.
I. histrioides, (G. F. Wilson) S. Arnott: Iris sect. Reticulata.
I. Hoogiana, Dykes: Iris subsect. Hexapogon.
I. Hookeriana, M. Foster: Iris subsect. Pseudoregelia.
I. humilis, Bieb.: Iris ser. Spuriæ.
I. iberica, Hoffm.: Iris subsect. Oncocyclus.
I. imbricata, Lindl.: Iris ser. Elatæ.
I. innominata, L. F. Henderson: Iris ser. Californicæ.
I. japonica, Thunb.: Iris subsect. Evansia.
I. jordana, Dinsm.: Iris subsect. Oncocyclus.
I. juncea, Poir.: Iris sect. Xiphion.
I. Junonia, Schott. & Kotschy: Iris ser. Elatæ.
I. Kaempferi, Sieb.: Iris ser. Lævigatæ.
I. kashmiriana, Baker: Iris ser. Elatæ.
I. Kerneriana, Aschers.: Iris ser. Spuriæ.
I. Kochii, Kerner: Iris ser. Elatæ.
I. Kolpakowskiana, Regel: Iris sect. Reticulata.
I. koreana, Nakai: Iris ser. Chinenses.
I. Korolkowii, Regel: Iris subsect. Hexapogon.
I. kumaonensis, Wall.: Iris subsect. Pseudoregelia.
I. lacustris, Nutt.: Iris subsect. Evansia.
I. lævigata, Fisch.: Iris ser. Lævigatæ.
I. linifolia, O. Fedtsch.: Iris subgen. Scorpiris.
I. longipetala, Herb.: Iris ser. Longipetalæ.
I. Lortetii, Barbey: Iris subsect. Oncocyclus.
I. lurida, Soland.: Iris ser. Elatæ.
I. macrosiphon, Torr.: Iris ser. Californicæ.
I. mandschurica, Maxim.: Iris ser. Pumilæ.
I. Mariæ, Barbey: Iris Helenæ (subsect. Oncocyclus.)

I. maritima, Lam.: I. spuria var.? (ser. Spuriæ).
I. masia, Dykes: I. Grant-Duffii (ser. Syriacæ).
I. Meda, Stapf: Iris subsect. Oncocyclus.
I. melanosticta, Bornm.: I. Grant-Duffii (ser. Syriacæ).
I. mellita, Janka: Iris ser. Pumilæ.
I. mesopotamica, Dykes: Iris ser. Elatæ.
I. Milesii, M. Foster: Iris subsect. Evansia.
I. minuta, Franch. & Sav.: Iris ser. Chinenses.
I. missouriensis, Nutt.: Iris ser. Longipetalæ.
I. Monnieri, DC.: I. spuria ssp.? (ser. Spuriæ).
I. Munzii, R. Foster: Iris ser. Californicæ.
I. nepalensis, D. Don: Iris decora (subgen. Nepalensis).
I. ochroleuca, L.: I. orientalis, Mill. (ser. Spuriæ).
I. orchioides, Carr.: Iris subgen. Scorpiris.
I. orientalis, Mill.: I. spuria ssp.? (ser. Spuriæ).
I. orientalis, Thunb.: Iris ser. Sibiricæ.
I. palestina, Boiss.: Iris subgen. Scorpiris.
I. Pallasii, Fisch.: I. ensata (ser. Ensatæ).
I. pallida, Lam.: Iris ser. Elatæ.
I. paradoxa, Steven: Iris subsect. Oncocyclus.
I. persica, L.: Iris subgen. Scorpiris.
I. pinetorum, Eastw.: Iris ser. Californicæ.
I. Potaninii, Maxim.: Iris ser. Pumilæ.
I. prismatica, Pursh: Iris ser. Prismaticæ.
I. Pseudacorus, L.: Iris ser. Lævigatæ.
I. pseudopumila, Tineo: Iris ser. Pumilæ.
I. pumila, L.: Iris ser. Pumilæ.
I. Purdyi, Eastw.: Iris ser. Californicæ.
I. Reichenbachiana, Klatt: I. spuria var.? (ser. Spuriæ).
I. Reichenbachii, Heuff.: Iris ser. Pumilæ.
I. reticulata, Bieb.: Iris sect. Reticulata.
I. Rosenbachiana, Regel: Iris subgen. Scorpiris.
I. Rossii, Baker: Iris ser. Chinensis.
I. ruthenica, Ker-Gawl.: Iris ser. Ruthenicæ.
I. Saari, Schott: Iris subsect. Oncocyclus.
I. scariosa, Willd.: Iris ser. Pumilæ.
I. scorpioides, Desf.: I. alata (subgen. Scorpiris).
I. setosa, Pall.: Iris ser. Tripetalæ.
I. sibirica, L.: Iris ser. Sibiricæ.
I. sikkimensis, Dykes: Iris subsect. Pseudoregelia.
I. sindjarensis, Boiss.: Iris Aucheri (subgen. Scorpiris).
I. Sintenisii, Janka: Iris ser. Spuriæ.
I. Sisyrinchium, L.: Iris subgen. Gynandriris.
I. sofarana, M. Foster: Iris subsect. Oncocyclus.
I. speculatrix, Hance: Iris subsect. Evansia.
I. spuria, L.: Iris ser. Spuriæ.
I. Stocksii, Boiss.: Iris subgen. Scorpiris.
I. stolonifera, Maxim.: Iris subsect. Hexapogon.
I. subbarbata, Joo: I. spuria var.? (ser. Spuriæ).
I. subbiflora, Brot.: Iris ser. Pumilæ.
I. Susiana, L.: Iris subsect. Oncocyclus.
I. tectorum, Maxim.: Iris subsect. Evansia.
I. tenax, Dougl.: Iris ser. Californicæ.
I. tenuifolia, Pall.: Iris ser. Tenuifoliæ.
I. tenuis, Wats.: Iris ser. Californicæ.
I. tenuissima, Dykes: Iris ser. Californicæ.
I. Thompsonii, R. Foster: Iris ser. Californicæ.
I. Tigridia, Bunge: Iris ser. Pumilæ.
I. tingitana, Boiss. & Reut.: Iris sect. Xiphion.
I. tridentata, Pursh: Iris ser. Tripetalæ.
I. tripetala, Walt. not L.f.: I. tridentata (ser. Tripetalæ).
I. trojana, Kerner: Iris ser. Elatæ.
I. Tubergeniana, M. Foster: Iris subgen. Scorpiris.
I. unguicularis, Poir.: Iris ser. Unguiculares.

I. variegata, L.: Iris ser. Elatæ.
I. Vartanii, M. Foster: Iris sect. Reticulata.
I. verna, L.: Iris ser. Vernæ.
I. versicolor, L.: Iris ser. Lævigatæ.
I. virginica, L.: Iris ser. Lævigatæ.
I. warleyensis, M. Foster: Iris subgen. Scorpiris.
I. Wattii, Baker: Iris subsect. Evansia.
I. Willmottiana, M. Foster: Iris subgen. Scorpiris.
I. Wilsonii, C. H. Wright: Iris ser. Sibiricæ.
I. Winkleri, Regel: see Iris sect. Reticulata.
I. xiphioides, Ehr.: Iris sect. Xiphion.
I. Xiphium, L.: Iris sect. Xiphion.